THE
# ELECTRICAL REVIEW

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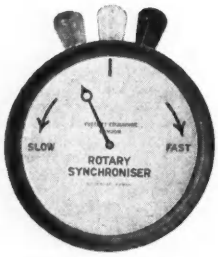


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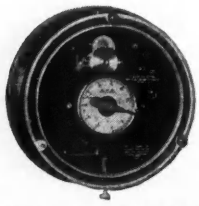

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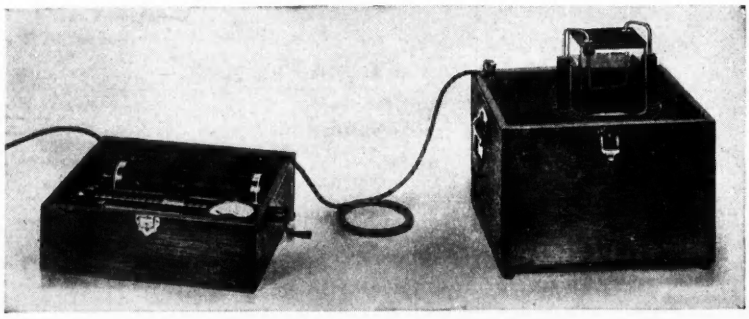

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THE
# ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

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# Direct Current Transmission

## Advantages and Drawbacks

THE higher the voltage adopted for transmitting energy over a long distance and the larger the blocks of power to be transferred, the more attractive does the idea of employing direct current become. Compared with standard AC methods, appreciable savings are to be expected in capital expenditure and in operation losses, and there would undoubtedly be a good many other merits in addition.

To get rid of the difficulties inherent in the use of AC due to inductance and capacity, with the consequently adverse effect on voltage regulation (and, one may add, the mathematics they entail), to eliminate skin effect and to reduce corona losses at corresponding voltages would be obviously worth while doing. Again, the absence of charging currents would permit the use of high-voltage cables, where desirable, at working voltages that would certainly be not less than $\sqrt{2}$ times those permissible with AC and might be considerably more.

All these advantages are just what modern bulk transmission requires. Yet for that purpose DC fails us. It has not been found practicable to adapt it to large scale working—including generation, conversion and inversion. Inversion to AC is a very necessary corollary, since the induction motor is supreme in the vast majority of motive power applications and would be a decisive factor even if the economy of the four-wire AC system had not brought about its adoption as a standard for distribution.

### Transformation Problems

The predominating quality of AC is its almost unlimited flexibility, in that it enables the voltage of generation to be raised or reduced to any required value by static apparatus of high reliability and efficiency, each electrical unit being of the capacity most appropriate in the circumstances. That flexibility has not been attained in any DC scheme.

Some fifteen years back an attempt to rehabilitate DC transmission was embodied in the ingenious Calverley-Highfield transvertor. Accepting the principle of AC generation, this invention made use of phase-multiplying transformers in connection with a rotating brush gear and fixed commutator to provide uni-directional high-voltage current to be changed to AC at the remote end of the line. Another interesting development was the mercury-jet wave rectifier, experimental work on which was described in our columns by W. E. French six or seven years ago.

These somewhat specialised applications, however, provided no real substitute for transformers on our large supply systems, but more recently hopes have been entertained that grid-controlled rectifiers or the Marx arc-valve might solve the problems of primary rectification and secondary inversion.

Methods of DC transmission are not without their own great drawbacks as was pointed out in a paper read before the I.E.E. by Mr. H. Rissik at the beginning of 1934 and by several speakers in the subsequent discussions. Its use implies possible troubles due to electrolysis, while the absence of dielectric losses in cables may be poor recompense for osmotic troubles; also metering at high DC voltages has yet to be tackled.

### American Investigations

DC transmission is to the fore again just now because of the researches into the whole subject that have been started by Professor E. C. Starr, at Bonneville, U.S.A., with the support of substantial funds. In this issue Mr. Rissik discusses the main problems that still await investigation. The longest AC lines at present in the United States are those between the Bonneville and Grand Coulee Dams (235 miles) and between Boulder Dam and Los Angeles (275 miles). If the investigations yield good results it is expected that their cost will be defrayed many times over in the completion of the Bonneville-Grand Coulee scheme alone.

It has been calculated that the possible field for DC transmission is restricted to conditions in which the length of line exceeds 100 miles or the blocks of power transmitted exceed 100,000 kW. Unless the investigations at Bonneville badly upset this estimate, it is unlikely that they will show DC transmission to be generally suitable for conditions in Great Britain in any easily foreseeable future.

That is not by any means to say that the subject is of merely academic interest to electrical engineers in this country. Our manufacturers do not live entirely upon what the home market can provide, and in the Empire there will be plenty of scope for bulk transmission of power over very long distances. For some of these DC will probably be at least considered and British manufacturers should be technically prepared to meet the conditions.

**I.E.E. Honours**

HEADING the list of distinctions bestowed by the Institution of Electrical Engineers comes the Faraday Medal. This is presented each year to an eminent engineer or scientist, who is not necessarily a member of the I.E.E. This year's award is to a Past-President, Dr. Alexander Russell, to whose guidance in their student years at Faraday House, many leading electrical men owe so much. His review of the History of the Institution in our issue of November 24th, showed his knowledge of and interest in its affairs. The award of the Faraday Medal follows three years after Dr. Russell's election as Honorary Member —another tribute that is bestowed annually and is not confined to existing members. This year's recipient of the honour is Mr. Roger T. Smith, who was President in the year after the termination of the last war. As electrical engineer to the G.W.R., Mr. Smith was a notable pioneer in the use of electricity for power in railway yards and workshops. More recently he has been associated with the grid in a consultative capacity, but his electrical interests are, again, more widely spread than a mere summary of his professional activities could indicate.

**Chiefs' Salaries**

LAST week we reported the decision of the Norwich City Council to withdraw from the Joint Committee formed to frame a scale of salaries for chief engineers of municipal supply undertakings, mainly as a result of the protest made when the Council offered a salary lower than that payable under the Walker Scale for the post of city electrical engineer. Last week, too, the Morecambe and Heysham Council went even further in offering a commencing salary of £575 (rising by £75 increments to £800) for a position stated by the A.M.E.E.-E.P.E.A. Standing Joint Committee to be worth £945. It is most unfortunate, as a correspondent in this issue points out, that the principal sufferers are those engineers who, although fully qualified, refrain from applying for such positions. We fear that his suggested remedy is hardly likely to be adopted—the raising of deputy engineers' salaries to diminish the gap between their remuneration and that of their chiefs. The feasible remedy is the education of local councillors to a proper appreciation of the value of a good man at the head of a most important commercial undertaking.

**Machine-tool Drives**

FIGURES supporting the case for the individual driving of machine tools are given by Mr. S. J. R. Allwood in his chairman's address to the I.E.E. East-Midland Sub-Centre. From a number of tests he finds that for the individual drive the average load is about 40 per cent. of the motor rating with no-load losses of from 15 to 20 per cent.; for the group drive the corresponding figures are 60 and 30 per cent. The intermittent loading of the separate motors affects the power factor adversely so that it is usually only about 0.6 as against 0.75 with the group drive. The higher cutting speeds possible with modern steels further strengthens the argument, as the horse-power required (which is directly proportional to the rate of removal of the metal) is greater and can be readily calculated.

**The Oil Hazard**

UNTIL we get a fluid insulating medium for transformers and switchgear that approaches oil in technical qualities and cost, oil will continue to be a principal cause of the serious nature of fires in power stations and sub-stations. Even then turbine oil has proved more than a menace on several occasions. Nevertheless, oil is rarely the origin of a fire, which is usually due in the first place to failure of insulation, but the inflammable and explosive gases given off when oil is heated to a relatively high temperature add enormously to the intensity of the fire, while the fluidity of the oil causes it to spread with the kind of perilous rapidity that was so well demonstrated by the E.R.A. film at the I.E.E. the other evening. Methods of extinguishing oil fires, therefore, fall into the category of curative measures, the preventive aspect being bound up in questions of the reliability of insulation (more especially its adequate maintenance) and the physical segregation of plant items in accordance with the recommendations of the Electricity Commissioners' Committee relating to Fire Risks at Generating Stations, which derive additional force now from the addition to ordinary operating hazards of the possibility of enemy action.

**Fire-fighting Equipment**

IN the E.R.A. Report, which should be regarded as a later appendix to that of the Commissioners' Committee, while the capabilities of the various forms of fire extinction are very fully indicated, guidance as to their use is given in only general terms. This cannot very well be helped, since the appropriate choice of method and its applications varies very widely with the multitudinous examples of plant layout that are to be found in existing installations. To get the fire under control quickly is the main thing, but regard must be paid to the possible effects of water, foam and gases on speedy restoration of supply, the safety of apparatus and, by no means least, the health of the men engaged on the work. Such considerations notwithstanding, some broad principles emerge. One is the need in the larger installations for automatic action that is prompt but at the same time discriminative against unnecessary operation; e.g., the shielding of thermostats must be avoided and fire detectors are too sensitive except to give warning. Portable extinguishers have their uses, but often cannot be brought near enough to the seat of the trouble. Where jets are used the pressure should be at least 50 lb. per sq. in. at any nozzle. Back-up protection is always necessary and hydrants should be selected after consultation with the fire-brigade whose full co-operation in all ways should be secured. Two other requirements are that the staff should be adequately trained in fire fighting and that possible seats of fire should be kept scrupulously free from odd scraps of rag, which by smouldering may cause re-ignition of inflammable vapour after the fire appears to have been mastered.

**The Truce**

SOME more or less representative groups in the electricity and gas industries got together and concluded a "truce" a short time ago. They agreed not to try to seize one another's customers for the duration of the war—a very good thing for the gas industry, which has been on the defensive for some years now. For our part we can see no harm in replacing an obsolescent gas system by up-to-date electrical methods, nor, for that matter, substituting an efficient gas system for an inadequate or unsatisfactory electrical arrangement. It is consequently with out any qualms that we see the electricity supply industry going ahead in its drive for greater efficiency in industry and the home. No harm can be done to the cause by such improvements, but a great deal of damage could be sustained by the electrical industry if it agreed to cease all development for an indefinite period. Let us, therefore, continue to do what we can within the limits necessarily imposed by the war and not surrender hard-won ground in the misguided belief that we are thus contributing to victory.

**Guaranteed Refrigerators**

THE modern electric refrigerator of reputable make is a very reliable piece of apparatus, but even the best equipment is dependent upon a number of things beyond the control of the manufacturer. The decision of the suppliers of seven leading makes of domestic refrigerators to guarantee their machines for a year is a wise one and should prove a further compelling factor in the sale of the apparatus. In view of the soundness of the refrigerators concerned, we do not suppose that the guarantee will involve the manufacturers in much trouble.

# STEEL STRIP MANUFACTURE

## Continuous Cold Rolling at a Newport Works

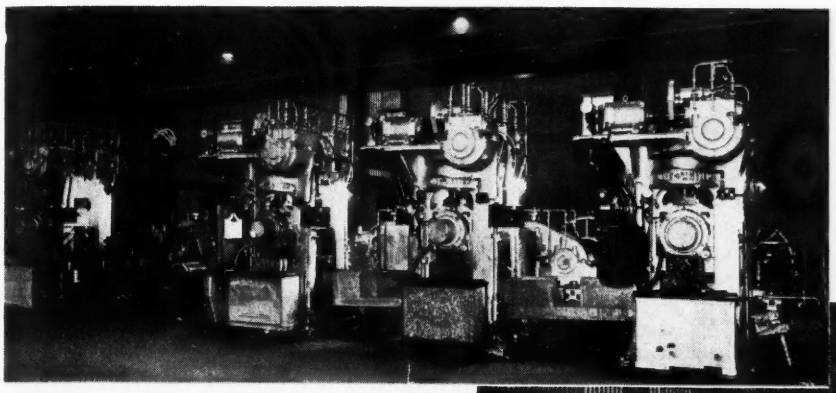
PRODUCTION of cold rolled steel strip has been very much speeded up at the Newport (Mon.) works of the Whitehead Iron & Steel Co., Ltd., by the installation of a new continuous rolling plant capable of dealing with approximately 2,000 ft. of strip per minute. Especial interest is attached to the installation on account of the ingenious design of the control gear, for which the Metropolitan-Vickers Electrical Co., Ltd., under the supervision of the chief engineer of the works, Mr. H. G. Weaver, M.I.E.E., was responsible.

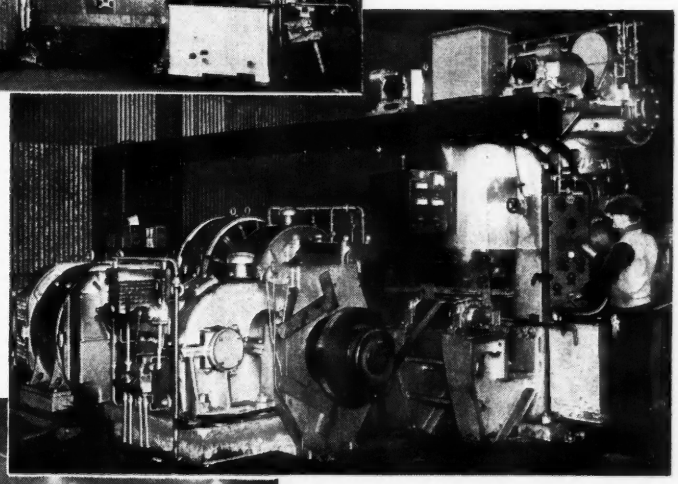
Though covering a most complicated and elaborate process, the actual method of control is almost unbelievably simple, and it is a remarkable fact that after a half an hour's instruction the operators completely mastered it and have not spoilt a single coil. Moreover, a comprehensive system of electrical interlocks makes the plant completely foolproof and obviates any risk of two operators at different control points of the plant operating the controls simultaneously.

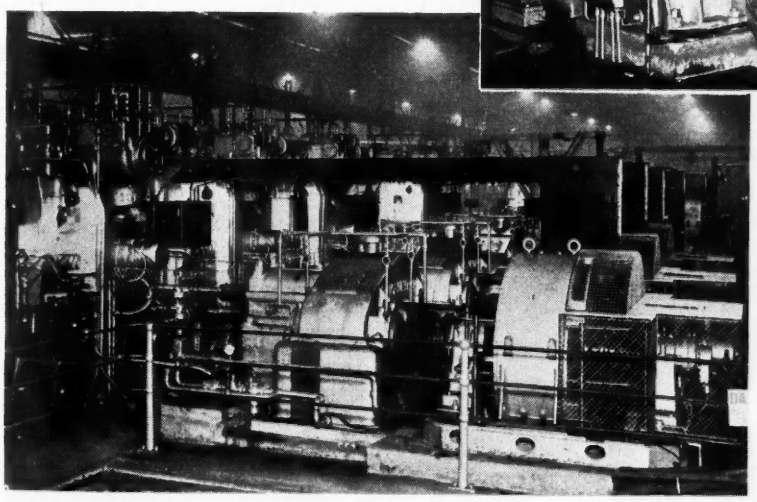
The main plant consists of a set of four identical four-high stands and two reels, arranged in tandem, so that the first three stands and the first reel can be run as one unit, or all four stands and the last as one unit, according to the thickness of the strip required. Each stand is of the four-high type with 7½-in. diameter and 18-in. diameter by 14-in long rolls.

In addition to this main plant there are two separate single stand and reel units of similar design to those in the main mills, one of the same size as the main units and the other with 8-in. diameter and 20-in. diameter by 18-in. long rolls. Two other small mills are also available. These are two-high models with hand-operated screw-downs pressing straight on to the rolls. The larger, which has 12-in. diameter rolls, is operated by a DC 120-HP 400/1,200-RPM motor with contactor starter and shunt control, through a 36-in. G.E.C. magnetic clutch. With this the motor is kept running all the time, starting and stopping being effected by means of master switches operating the clutch. The other machine is identical except that it is smaller (8-in. rolls and 40-HP motor) and has a mechanical clutch. The use of these single mills will be described later.

The main mill motors are of the open, heavy steelworks type, with overload capacity of 50 per cent. for 5 minutes and 100 per cent. for 30 seconds. Stands Nos. 1, 2 and 3 of the tandem mill are driven by 500-V DC motors controlled by the Ward-Leonard system to produce 0/250/250-HP at 0/300/750-RPM, while the motors for stand No. 4 and the small single mill are rated at 0/250/250-HP at 0/400/800-RPM. All the reel motors are of the enclosed ventilated type, having the same overload capacity as the main mill motors and are rated at 0/60/60-HP at 0/300/1,200-RPM.







**The new continuous cold rolling plant at the Whitehead Iron & Steel Company's works. The centre picture shows No. 4 stand and reel. Note the master control and meter panels and the low oil pressure warning**

As already mentioned, the main mills are of the four-high type. The two working rolls are driven through gearing from the main motors, the pressure necessary to produce strips of the required thickness being transmitted to them by means of backing-up rolls which run loose at the top and bottom. The pressure is applied by means of two screw-downs situated above the rolls at the front and back, and, as a certain amount of opposition is required, a hydraulic pump and accumulator system is provided for supporting the rolls and tending to keep

them apart. Separate totally enclosed industrial-type series-wound motors developing 4½-HP at 750-RPM operate each of the screw-downs through double worm reduction gears, giving a speed reduction of 1,000 to 1, and magnetic brakes are fitted, two on each stand. For the hydraulic pump motor there is a 3-HP 725-RPM motor equipped with direct-on-line contactor starter and limit switches.

### Lubrication

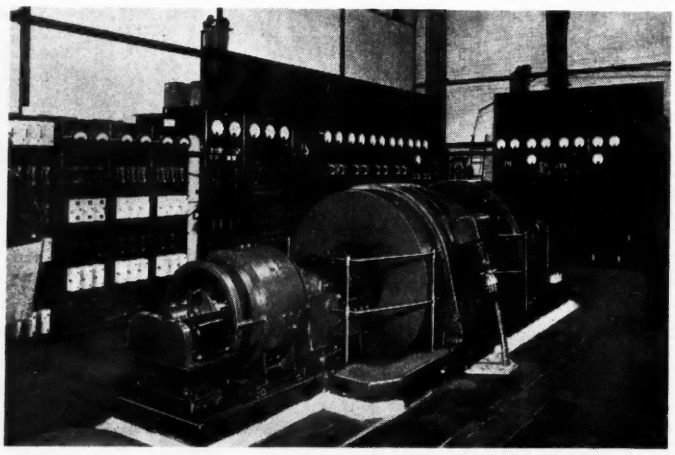
Lubrication of the mills presents no mean problem, and a special section of the shop has had to be set aside to accommodate the special equipment necessary, for which Streamline Filters, Ltd., were responsible. For the main "Morgoil" roll bearings on the mills, 2,000 gals. of oil are kept in constant circulation by means of two Stothert & Pitt pumps, driven by 5-HP, 725-RPM squirrel-cage motors. The bearings are supplied from a pressure vessel into which the pumps deliver, and the pump motors are automatically operated by pressure switches on this vessel. The starters are of the direct-on-line contactor type.

Should the pressure of the oil at the rolls fall below normal, pressure switches operate a hooter, illuminate a visible signal, and after 10 seconds delay shut down the mill, which cannot be restarted until the oil pressure is restored. Small pumps driven by 2-HP, 1,500-RPM s.c. motors, with direct-on-line starters, supply oil to the main gearing and screw-down gearing, each mill stand being an independent system.

The coolant for lubricating and cooling the rolls is stored in two tanks, each holding 8,000 gals., from which it is pumped to the mills and squirted on the rolls. There are four Worthington-Simpson pumps, two driven by 10-HP, 2,950-RPM squirrel-cage motors, and two by 20-HP, 1,450-RPM similar type motors. All have direct-on-line starters of the contactor type, and are operated in accordance with the mill requirements, which, of course, are constantly changing.

### Process Described

The raw material for the mill consists of coils of strip steel, which are produced in the adjoining hot rolling mills. These coils measure about 45 in. in diameter, while the strip is from 3 to 14-in. wide and from 0.06 in. to $\frac{3}{16}$ in. thick. When received from the hot rolling mills, the coils are done up tightly, so before further treatment they have to be slackened off. This is done by means of an uncoiling swift, or revolving table, which uncoils them and recoils them in the opposite direction. To lift the coils on to the swift there is a 1½-ton electric jib crane which is also used for hoisting them, after recoiling, into cradles and passing them to the pickling department to remove scale which would, if left on, spoil both the rolls and also get into the metal. These preliminaries over, the strip is ready for feeding into the mills.



Motor-generator set and contactor gear for the tandem mills

The whole of the machinery is controlled from compact panels on the stands. These panels, which are mounted on swivel brackets so that they can be swung out of the way when changing rolls, incorporate controls for the mills, reels and screw-downs, and are so interlocked that if two operators try to work the controls simultaneously, dynamic as well as electric brakes come into action and everything immediately comes to a standstill. All the machines can be similarly shut down manually in an emergency, safety buttons being provided on each panel. In the case of the master control panel on the fourth (last) stand, all the controls on the other three panels must be in the "off" position before it can be operated.

Separate vernier controls are used for adjusting the speed of the stand motors, while inching controls on each panel enable the whole mill or each stand to be inched at will, speed-up devices making it possible to take up loops in the strip between the various stands without upsetting the set speeds. The two screw-downs on each stand can be operated individually or both together at two speeds, in both directions.

As the strip is supplied with a thickness guaranteed to be accurate to 0.00025 in., it will be appreciated that every care is taken to secure uniformity. To do this, an exact and constant tension in the strip is essential. Accordingly, the reel motor has been designed to give a constant tension at all speeds, a carbon pile type regulator being operated by a special control on the last stand. Control of the tension between the reels and the preceding stand is automatic up to 150 per cent. of the reel motor rating. An equally important requirement necessary to ensure the exact tension between each stand all the time is that the speed of every stand should be synchronised.

### Synchronising Stand Speeds

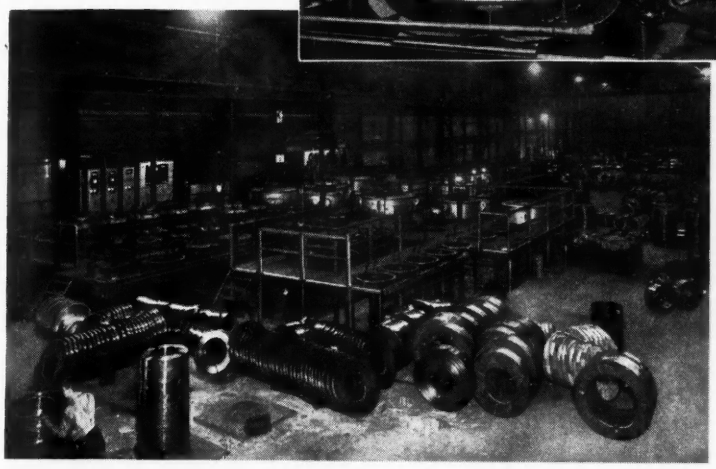
For this purpose speed controls and meter panels are fitted to each stand showing the loads (and thus the tension) on both the mill and reel motors. Further dials show the position of the screw-downs by means of "Selsyn" counters. Tachometers also show the speed of the motors and the amount of strip passed per minute (on an average this is about 600 to 750 ft). Flying micrometers (Taylor, Taylor and Hobson) indicate the thickness of strip to 0.0001 in. during rolling.

As already mentioned, either three or all four stands can be employed as required, there being a selector switch on the master control panel to bring into service the appropriate reel and cut out the last stand if only three mills are being used. When the coil of strip is finished, brakes are applied to the end of the reel drum and cause it to collapse, so enabling the coil to be pushed off by compressed air on to a trolley. The compressor used for this purpose is situated in the same room as the lubrication plant, and is a Broom & Wade machine with a 25-HP, 725-RPM squirrel-cage motor with direct-on-line starter.

All the mills are controlled on the Ward-Leonard principle, and for this two motor-generator sets are provided, one for the tandem mills and the other, a combined set, for the two single mills. The former set comprises a 1,200-HP slip-ring motor and an 835-kW generator with a counter-e.m.f. generator, booster and exciter. The motor, which has a liquid starter, runs direct off the 6,000-V, 3-phase, 50-cycle main supply at 1,000-RPM. The combined set for the two single stands is driven by a similar slip-ring motor running at the same speed but of lower rating (1,000-HP); a liquid starter is again provided. Two separate generators, both direct driven, of 250- and 400-kW, serve the small and large mills respectively, the auxiliary equipment including two boosters, an exciter and two counter-e.m.f. generators.

Oil switches of 250,000-kVA rupturing capacity housed in sheet steel cubicles give high-voltage control

of the motor-generators. These, as well as the open-type switchboards accommodating the automatic contactor gear for the various low-voltage circuits, are all located in a sub-station leading from the main factory. As already mentioned, all the controls for the machines are situated in cabinets fixed on the mill stands. The wiring from the power house is carried in easily accessible trenches in the floor as far as the back of the mills, whence it is taken inside columns to overhead ducts. Accessibility is thereby achieved throughout its whole run, and alterations or extensions present no difficulties. Moreover, the wiring is right out of the way, and the machinery can, if thought desirable later, be rearranged with the minimum of difficulty. The c.t.s. 15-core cable used (Edison Swan) is provided with a special flexible armouring over which is a further protective cab-tyre covering.



**Annealing furnaces with (right) the control panels**

After leaving the mills the strip passes on to the slitting machines, which cut it to the required width. These machines, of which there are twelve, take a shaving of metal from each side, and can split a strip into as many as six widths at one operation. They were made by Brookes (Oldbury), Ltd., and are driven by motors of 10-25-HP, 725-RPM.

Thus slit, the coils are built up into stacks of anything up to 5 tons in weight. To assist in this, 7½-ton Vaughan overhead cranes with 68-ft. spans are brought into service. Actually, there are four of these cranes installed in the factory, two in each bay, and they are used for all heavy lifting work. Motors of 22½-HP, 500-RPM are incorporated for the hoist, and the same for the long travel, 3-HP, 500-RPM units being used for the cross travel. These crane motors are run on 250-V three-wire DC supply (two cranes on each side of the three-wire system), provided by two 500-A, 250-V G.E.C. mercury arc rectifiers of the pumpless, steel-clad, air-cooled type.

When it leaves the mills the strip is extremely hard and has to be annealed before it is ready for use. For this process eleven G.E.C.-Grunewald bright annealing furnaces are available in various sizes ranging from 20 to 44 in. in diameter with loadings of from 50- to 120-kW. These are fully automatic, and after the stacks of coils (referred to above) have been lifted into the furnaces and the operation started, nothing remains to be done until the time comes for cooling off.

The furnaces work at about 800 deg. C., the temperature being kept constant by means of automatic regulators operated by thermo-couples (Electroflo and Cambridge). Pointers on the instrument panel indicate both the temperature for which the furnace has been set, actual furnace temperature, and also the actual temperature of the charge inside, a pyrometer couple going right down into the centre of the charge. Cambridge and Electroflo temperature recorders are also provided. All the furnaces are hermetically sealed, and a striking feature is the amazing coolness of the outsides, and we were told that the lagging is so good that the temperature does not drop as much as 5 deg. in an hour. The furnaces operate from a 400-V, 3-phase, AC supply provided by three 300-kVA and one 500-kVA G.E.C. transformers which step down the 6,000-V supply received from the Newport Corporation. The load is almost constant day and night at about 1,000-kW.

The heating of a charge takes 7 to 12 hours, according to the weight. The subsequent cooling off is a very gradual process, and for this a number of special cooling cells are provided, so enabling the furnaces to be freed for further use and rendering production truly continuous. When cold the strip is quite soft, so soft, in fact, that it is liable to crumple on the surface when bent. To rectify this, therefore, it is passed through one of the single stand and reel units for the purpose of imparting a hard skin. This "skin passing," as it is called, reduces the thickness about 0.00025 to 0.001 in., or in special cases as much as 0.005 in.

The new plant installed in the works adds 1,500 kVA to the company's electricity requirements, and further increases its claim to be Newport Corporation's largest consumer. The maximum demand is now in the neighbourhood of 8,000 kVA and the annual consumption is approximately 25 million kWh.

The whole of the electrical plant for the mills was supplied by the Metropolitan-Vickers Electrical Co., Ltd., the mills themselves being made by the Davy & United Engineering Co., Ltd. The General Electric Co., Ltd., was responsible for the annealing furnaces. The installation work was carried out by the company's own staff. We are indebted to the company for its permission to publish this article, and to Mr. H. G. Weaver, the chief engineer, for his assistance.

## Measuring High Voltages

NEW standard rules for the measurement of high voltages with the aid of sphere-gaps have been issued. They extend and supersede those presented in 1929 (B.S. 358) and fresh calibration tables have been prepared by E.R.A. The available experimental figures from all sources were given due weight and smoothed by means of curves based upon known relations between the various parameters.

The new tables have received a large measure of international approval, and at a meeting of the Sphere-gaps Subcommittee of the International Electrotechnical Commission held in Paris last July, it was agreed that those countries which proposed to issue national standards based on these tables were recommended to do so with the proviso that the figures might differ from the final I.E.C. values by an amount not exceeding 1.5 per cent. The tables are nevertheless considered by E.R.A. to represent the most probable values of breakdown voltage for given sparking distances between the standard spheres. Line diagrams are included to enable the calibrations and interpolations to be made rapidly and with an accuracy adequate for normal practice. Copies of this British Standard (No. 358-1939) may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1., price 2s. 2d. post free.

# CIRCUIT-BREAKER CONTACTS

## Discovering a Remedy for Failures

### By J. Anderson, M.I.E.E.

A LIST of oil circuit-breaker failures accompanied by explosions of gas is given in "Electrical Accidents" for 1938, where the necessity for breaking-capacity tests is urged. An analysis of the failures shows that most of them were due to breakdown of the insulation and no breaking test would have shown that up and it is doubtful if explosions could have been prevented.

In three cases the blame is laid on insufficient breaking capacity for the situations in which they were installed, but a tested breaker can fail from the same cause. It is also doubtful if these breakers failed through incapacity to break the circuit. Tests we have made show that an ignition of gaseous mixture in the air space was a far more likely cause of the trouble. It is not difficult to find a current, possibly well within the "breaking" capacity, which in one, two or three shots will give a mixture which on ignition will shatter the breaker.

The first test was to put thermometers in the stream of bubbles from an arc burning continuously in oil and we found that with the thermometer as close to the arc as we dared put it the temperature rise was only a few degrees. Other tests consisted in firing off a large number of consecutive shots with a small breaker and we found practically no temperature rise in the air space above the oil.

A further test consisted in collecting the gas from an arc burning continuously in oil in an inverted tumbler held in the hand. There was no appreciable temperature rise. The gas was slightly misty, denser at the surface of the oil and almost clear higher up, probably due to very fine carbon in suspension. When the tumbler was tilted to allow bubbles to escape, a puff of smoke accompanied each bubble, apparently showing that some chemical reaction took place. There was a slight difference in shade between the smoke from gas from a carbon arc and that from the gas with copper electrodes.

Our attention was then drawn to a Home Office report dealing with welding copper with acetylene flame where mention was made of the very explosive nature of the copper acetylide formed. That put us on the right track; a mere trace of acetylide acts as a detonator and on the slightest provocation ignites the mixture.

The remedy that jumps to the mind at once is to use metals other than copper so we tried cast iron, wrought iron, steel, aluminium, silver and all their combinations, but explosions still occurred. We then went back to carbon but ignitions happened through glowing particles coming up with the gas. Our next step was to reduce the air space by inserting blocks of wood, but it had to be very small to eliminate explosions. We sought to overcome the trouble by giving the gas time to become stable before it reached the air space either by making it follow a tortuous path, leak slowly out of a gas trap or pass through a canvas filter. All these methods proved more or less effective, but we found a better way in the course of our efforts to discover non-welding contacts.

We found everything "welded" in the breaker sense, not at all the sort of weld the welding shop would would care to turn out, but with quite enough adhesion to cause the breaker to fail to open or worse still to open a little way on the unwelded phases. Brass with plenty of zinc in it was found to be generally effective, particularly if the correct type of contact was used, the heel-toe clapper or contactor. Much to our gratification it was also found that explosions no longer occurred. For years we had been supplying brass arcing contacts on one size of high-voltage breaker in complete ignorance of its ideal properties.

The price to be paid for safety through the absence of bad welding or explosions is wear of the contacts and renewals are heavy on frequent duty. But oil breakers should not be used on frequent duty; the proper thing is an air breaker with magnetic blow out arranged to cause the arc roots to travel so rapidly along the arcing horns that practically no burning takes place. Care has to be taken with brass arcing contacts to see that no sparking or arcing occurs at the main copper contacts because the very slightest burning there is enough to touch off the explosive mixture.

# Temporary Joints

## Quick and Efficient Method with High-voltage Conductors

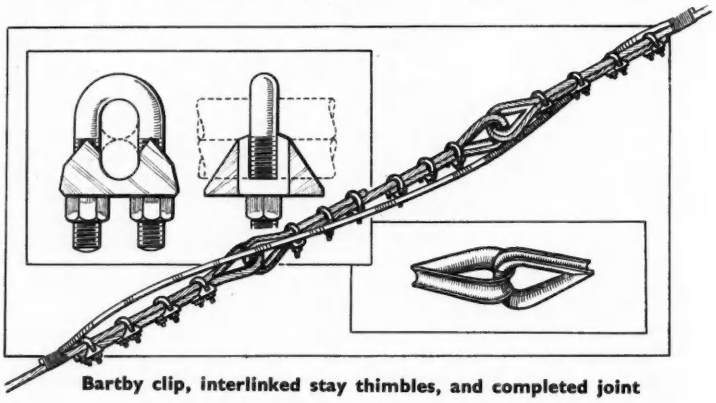
AT the present time methods of making temporary joints on high-voltage overhead lines are an essential A.R.P. consideration. If several breakdowns occur simultaneously, either in parallel feeders or ring mains, the time factor is of the greatest importance. It would be impracticable to run new section lengths of conductors or to insert mechanical joints at the breaks. If three wires are broken, the conductors at the breaks are usually damaged or burned. This would entail inserting short lengths of conductor with mechanical joints. Apart from the time necessary it is very questionable if the mobile gang would have sufficient joints at hand.

A simple, cheap and efficient joint can be made in the minimum of time. The joint consists essentially of two stay thimbles interlinked as shown in the diagram. These thimbles are available in every district stock and the sizes to suit the conductor can be selected. The conductor is passed round one of the stay thimbles until an overlap of approximately 2 ft. 3 in. is obtained. It is then shaped to the thimble with easy bends so that the conductor is not unstranded. The procedure in shaping, &c., is identical with that at a stay make-off, except that heavy spanners must not be used to pound the conductor to shape.

It is good practice if the conductors are of steel-cored aluminium to tape them individually with aluminium tape over the whole length of the make-off where the clips will rest when fixed in position. Four Bartby clips are then fitted on the conductor approximately 7 in. apart. A similar make-off can be made at the other broken end of the conductor.

The length of the conductor to be inserted is then measured and one end of it made off in the way already described on the stay thimble interlocked with the one already made off on the end of the conductor. The jointing of the conductor is completed by making off the loose end of the inserted length to the interlinked stay thimble at the other end.

In order to secure good electrical connection a jumper of conductor is bridged over the joint and carefully bound to the original wire. If the jumper is long it can be bound at intermediate points to prevent it from coming adrift. It will be appreciated that the joint so made will permit the line to be operated until a shutdown of sufficient length can be obtained to change the conductors or put in standard mechanical joints.



**Bartby clip, interlinked stay thimbles, and completed joint**

The joint has the following advantages over most temporary joints:—It can be made on any type of conductor; long lengths of conductor are not damaged and so have not to be cut out when a permanent joint is made; all materials used can be obtained from and returned to local stock; the minimum of time is taken; and no highly skilled labour is required.—J. M.

# SUPER-POWER TRANSMISSION

## The Use of Direct Current

By H. Rissik

IN a previous article* an account was given of the main technical difficulties associated with the long-distance transmission of power by means of alternating current and of the several methods of overcoming them that are available to-day. The continued existence of these difficulties alongside the rapid development in means for rectifying alternating current on a large scale had already led, some ten years ago, to a growing interest in the possible application of direct current to the bulk transport of electrical energy over great distances. In fact, the revival of interest in this topic, which had long lain dormant in the electrical engineering mind, found concrete expression in a number of papers presented in 1930 to the Second World Power Conference and prompted the author some time later to survey, in a paper which provoked considerable discussion at the time†, the basic problems involved in generating, transmitting and transforming electrical energy in the form of super-voltage direct current.

In spite of the relatively limited technical advances made since that time, the possibilities of this alternative are becoming increasingly attractive as economic circumstances are more and more forcing engineers to think in terms of powers and distances which are quite beyond the capacity of the present system of transmission if, as hitherto, no serious attempt is made to break away from the orthodox tradition.

In America, for example, it is clear that the engineering division of the Roosevelt Administration, in planning such power schemes as the Bonneville-Grand Coulee project, is confidently looking ahead to the day when all the varied sources of electric power in the United States—many of which are yet untapped—will be interconnected by a transcontinental grid whose individual links, besides being of enormous length, must be capable of transmitting powers of the order of 500 to 1,000 MW.

The late J. D. Ross was known to have envisaged the use of DC at 400 kV or more for this purpose, although shortly before his death (some months ago) he had been definitely interested in the Taylor system of transmission as being possibly the more immediately practicable alternative. It is interesting to learn, therefore, that the Bonneville authorities have now entrusted Professor Starr, of the Oregon State College, with task of investigating the immediate possibilities of super-voltage DC as a means of transporting electrical energy on the grand scale.

### Theoretical Advantages

Under such circumstances as these it is pertinent to review the problems which the protagonists of the DC system have yet to solve. Before doing so, however, let us summarise the theoretical advantages which they claim for their system. Very briefly, these are as follow :—

(1) *Conductors.* Corona and skin effect with AC lead to costly hollow conductors of large diameter at transmission pressures above about 200 kV, whereas with DC the cross-section of the conductor can be utilised to the full, thus leading to solid conductors of at least half the cross-section for the same voltage. The consequent reduction in ice, snow and wind loading in turn means lighter transmission towers.

(2) *Corona.* For the same voltage values the corona loss with DC is only some 60 to 70 per cent. of that with AC, while for the same conductor diameter the critical value of DC voltage has been found to be from 1.3 to 1.8 times the *peak* AC value.

(3) *Frequency.* As the transmission frequency is zero in the DC system, the inductive reactance ($X = 2\pi fL$) and the capacitive susceptance ($B = 2\pi fC$) of the transmission line are also zero. The voltage drop of the line is thus no longer a function of line inductance and capacitance, but is solely a resistance phenomenon.

(4) *Insulators.* Due to the absence of capacity current in suspension insulator strings an even distribution of potential along the chain is obtained. As the result, the DC/AC flash-over voltage ratio is considerably higher than the simple ratio of peak to RMS value and would seem to lie in the region between 2 : 1 and 2½ : 1.

(5) *Cables.* In DC transmission there is no cyclic stressing of the dielectric so that cable insulation can be stressed much more severely than it is at present with AC cables. In fact, the technique of cable manufacture to-day will permit the construction of single-core cables designed to carry DC at a potential of at least 250 kV to earth, i.e., 500 kV between positive and negative conductors. Furthermore, the absence of any permanent charging current enables DC cables to be used economically in long-distance power transmission where they may even compete with overhead lines, especially where wide river or sea crossings have to be made.

(6) *Stability.* As DC transmission is inherently asynchronous in character, the problem of transmission stability no longer arises. This is equally true of a system containing DC machines for both generation and utilisation, e.g., the Moutiers-Lyon system, and of a system comprising a DC transmission link between two independent AC power networks.

Of the above advantages of DC transmission the economic use of high-voltage cables is probably the one of greatest practical importance, for the gain in service reliability to be achieved by putting transmission circuits underground is too great to be lightly dismissed. On the other hand the behaviour of such cables under DC load conditions is a subject about which very little is as yet known. This brings us to the all-important question of what research is still necessary to-day in order that high-voltage DC transmission may become an accomplished fact. It is true that the 125-kV Thury system in operation between Moutiers and Lyon, and covering a total distance of nearly 300 miles (of which some 50 miles represents underground cable) gives us a certain amount of information to go upon. But this unique transmission system is relatively small and unimportant and cannot be fairly compared with present AC practice.

### Insulation Problem

In the first place, consider the problem of insulation. So far as overhead lines are concerned we have no reliable data—except some highly interesting information collected by J. S. Highfield in 1912—on the comparative flash-over values of insulator strings subjected to AC and DC voltage stresses. A string of insulators distributes the AC voltage among the units according to their relative capacitances. With direct current, however, the voltage distribution is no longer governed by capacitance, but by leakage conductance, a much more uncertain factor. Theoretically, and in practice if the insulators are uniformly wet, the potential gradient is a straight line. But under dry conditions the rate of dirt deposit, although equal on positive and negative insulator strings when they are at the same potential above earth, increases towards the high-voltage end of the string and apparently does so in proportion to the square of the voltage.

In the case of underground cables the insulation problem is complicated by the effect of the unidirectional electric field on the semi-mobile dielectric material of the cable insulation. The phenomenon of electrical endosmose encountered in DC cables may well prove to be a limiting factor in insulating such cables for really high voltages. Then, again, it is known that under a condition of DC stress the fall of potential in an impregnated paper dielectric is not distributed as it would be if the dielectric were of uniform resistivity throughout. This phenomenon, which is not present under AC conditions, may also limit the permissible working voltage in DC cables.

In the second place, although inductive reactance and capacitive susceptance—and their consequent effects—are no longer encountered in DC transmission, yet inductance and capacitance make themselves felt in terms of energy storage. The phenomenon of " soaking " which accompanies the static charging of a high-voltage DC cable, for example, is one which does not seem to have been satisfactorily explained as yet. The amount of energy that soaks into such a cable reaches values enormously greater than that to be expected from a consideration of the dielectric constant found under AC conditions. The cable continues to charge for days, and the charge takes twice as long to escape. The allied problem of releasing stored magnetic energy in a DC line is also one calling for further investigation.

Another point arising out of the fact that the DC system is characterised by zero frequency of transmission is that a DC line cannot carry reactive power. Where reactive power is

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* ELECTRICAL REVIEW, October 20th, 1939 (p. 517).

† *Journal of the I.E.E.*, 1934, Vol. 75, pp. 1-33.

required at the far end of such a line, as it will be if the transmission system feeds into an AC load area containing only a few synchronous machines, a number of synchronous condensers will have to be provided specially for that purpose.

In this connection the suggestion has been made that the necessary reactive power could be carried by an alternating component or "ripple" in the direct current transmitted. That may be true enough in theory, but in practice—in the conversion of AC to DC and vice-versa—this current ripple is in phase with, or slightly lagging upon, the generative voltage ripple, so that the harmonic power component transmitted is either active or lagging reactive power, whereas it is *leading* reactive power which has to be transmittted. Moreover, some means would have to be provided to change its frequency to that required by the load end of the transmission system. This fundamental problem opens up a fruitful field of research, and will no doubt have a most important bearing on the application of DC for long-distance power transmission.

Other hitherto unsolved problems which readily come to mind are the provision of suitable indicating, metering and relay equipment; protection against lightning surges and other transient disturbances; high-voltage DC switchgear; and electrolytic effects and system earthing.

### DC Transmission with AC Utilisation

The crux of the general DC transmission problem, however, remains the means of obtaining and utilising electrical energy in the form of DC at very high voltages. There are two main alternatives to be considered: The use of DC machines throughout as in the Thury system, or the adherence to existing AC practice along with the use of appropriate current-converting plant. A third alternative presents itself in the form of a compromise between the two; namely, DC generation and AC utilisation.

Recent developments would seem to indicate that the future of DC transmission lies with the second of these alternatives. The first is virtually ruled out of court by the fact that the inherent flexibility of AC distribution and utilisation is overwhelmingly against the use of direct current as a means of supplying electrical energy to the consumer. The AC transformer is an established fact, while the DC transformer is still a vision of the future. The third alternative, however, has definite possibilities where hydro-electric stations depending on vast quantities of water at low heads are under consideration. Triple-unit double-commutator DC generators designed to give an output of 60,000 kW at 75 kV and 300 RPM are by no means an impossible proposition. In fact, DC-machine designers would do well to remember here Nansen's aphorism: "The difficult is that which can be done immediately, the impossible that which takes a little longer." At any rate, a power station containing eight such DC sets would be in position to supply some 500 MW at line voltages up to 600 kV, which is the order of magnitude of the super-power transmission system of the immediate future.

In the case of steam stations of this size—incidentally these would have to be near the sea as their cooling water requirements are of the order of 50 to 100 tons per second—AC generation in units of 80,000 kW running at 3,000 RPM would be but a normal development from present-day practice. The issue, then, narrows down to the provision of a DC transmitting link between the generating station bus-bars and the corresponding bus-bars at the distant load centre. Such a link would comprise a DC transmission line together with rectifiers and invertors and their associated transformers at the generating and load ends.

### Economic Aspect and Technical Prospects

In the last analysis, therefore, the DC system of power transmission stands or falls by the economic comparison between an AC transmission line and a DC line with its terminal current convertors, for step-up and step-down transformers are clearly common to both AC and DC transmission links. In other words, DC transmission can justify itself only if the financial savings accruing from the use of a DC line are sufficient to pay for the necessary current-converting equipment (including the extra cost, if any, of the associated transformers as compared with normal AC power transformers).

Assuming this to be the case—as, in general, it will be—what are the technical prospects of such a system? Here, it must be admitted, we are still on uncertain ground. Granted that the rectification of alternating to direct current and the corresponding inversion of direct to alternating current are to-day accomplished facts, yet the scale of current conversion attained so far is lamentably small when judged by the standards of transcontinental power transmission.

The DC transmission system demonstrated at last year's Swiss National Exhibition in Zurich employing a grid-controlled mercury-arc rectifier and invertor operated at 50 kV and on that account created a considerable stir in responsible engineering circles on both sides of the Atlantic. But the power transmitted some 23 miles between the 6-kV bus-bars of the Wettingen generating station near Baden and the 6-kV bus-bars of the Exhibition sub-station was only 500 kW. At the same time recent tests have shown that for operating voltages of 50 kV such mercury-arc current convertors can be built successfully to handle throughputs of 20,000 kW per unit. This represents a distinct advance on the state of the art as it appeared even a few years ago, when 20-kV units of a few hundred kilowatts for supplying DC to broadcast transmitters were the rectifier manufacturer's last word in the high-voltage field.

So far as the mercury-arc type of current convertor is concerned, therefore, one may say that the basis for further study in the direction of high-voltage DC transmission is already available. The same holds good, although to a lesser extent, for the atmospheric-arc type of current convertor developed by Marx and his associates at Braunschweig and described some years ago by Dr. Thompson in an important paper.* So far as I am aware nothing further has been achieved with this remarkable high-voltage current convertor since the large-scale tests carried out at Zschornewitz in 1932. These tests went far to prove Marx's claim that a three-phase bridge-connected converting unit of this type could be constructed to handle 250 A at 400 kV, corresponding to a throughput of no less than 1,000 MW.

Apart from the fact that to deal with this amount of power at least forty-eight polyphase converting units of the mercury-arc type (connected in series-parallel) would be required, as compared with only six converting elements of the atmospheric-arc type, the latter arrangement has the further advantage that normal power transformers insulated for 400 kV between the three phases can be employed with a bridge-connected three-phase current converting unit. There remains, too, the possibility of constructing single-element current convertors of the hot-cathode mercury-vapour type for high voltages and large power outputs. America has always favoured the hot-cathode rectifier (phanotron) and grid-controlled rectifier (thyratron) and further developments in this direction will no doubt be awaited with interest by the planning authorities in the U.S.A.

### Lord Rayleigh's Prophecy

These, then, are the problems awaiting solution before high-voltage DC power transmission can become a successful competitor of the AC system. Kelvin declared as far back as 1907 that he had "never swerved from the opinion that the right system for long-distance transmission of power by electricity is the direct-current system." In giving some reasons for that opinion he recalled a conversation he had had with Lord Rayleigh in the 'eighties of last century. During the course of that prophetic conversation Lord Rayleigh said that he rejoiced to see alternating current coming in "because the whole world will now learn the subtleties of electrical science . . . . and after that they will come back to continuous current." Although Lord Rayleigh's prophecy may never be fulfilled in its entirety, Kelvin's statement was undoubtedly correct in principle if not in practice. And it remains to the modern protagonists of the AC system of power transmission to show that they, too, possess those qualities of vision, courage and ingenuity which found concrete expression in the engineering technique which we have inherited from the pioneers.

* *Journal of the I.E.E.*, 1934, Vol. 75, pp. 603-630.

## Ultra-Rapid Voltage Regulation

WHEN a heavy load is put on or taken off a generator, voltage regulation is hindered by the magnetic inertia of the machine and its exciter, which makes it impossible suddenly to alter the magnetic field of the machine.

To overcome this difficulty the Oerlikon Co. has built a new composite regulator incorporating its standard quick-acting regulator for dealing with small variations and an over-regulation device that takes over the adjustment of larger variations. This device applies immediately the maximum over-regulation for periods of different duration, depending upon the extent to which the voltage differs from the value it should have, and is put out of action again before this value is reached. The introduction and cutting out of the over-regulation device is caused by a contact, which is operated automatically when the voltage drops or rises by 2 per cent. In the former case all the resistances in the shunt circuit of the exciter are short-circuited, while in the latter case they are all connected.

Tests were carried out with a 2,500-kVA generator with normally dimensioned exciter, the generator being subjected to the load of a squirrel-cage induction motor, from light load. The starting current was equal to about 50 per cent. of the rated current of the generator. With the ordinary quick-acting regulator, normal voltage was reached within about 2.6 sec., while with the ultra-rapid regulator the time was only 0.8 sec.

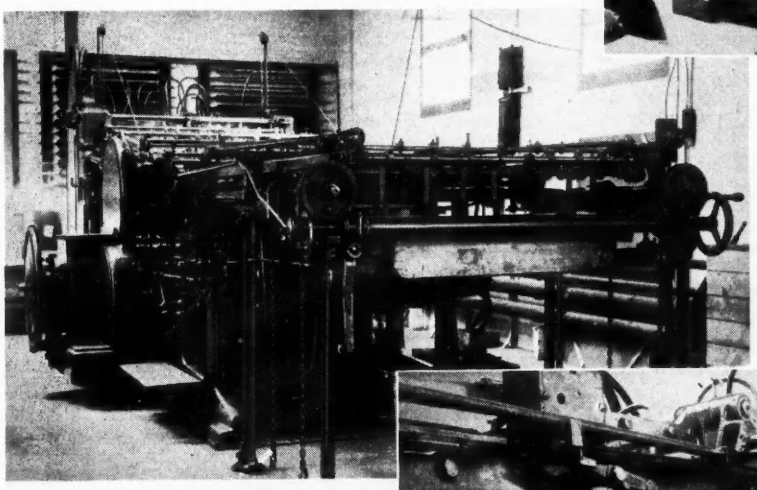
# COLOUR PRINTING

## Up-to-date Installation at a Peterborough Works

WHEN Geo. C. Caster & Co., Ltd., commercial and colour printers, recently transferred their works from Chapel Street to Cromwell Road, Peterborough, they took the opportunity of modernising their plant and installing new equipment almost throughout. Although the company is engaged principally on the production of general stationery and printing, it specialises in high-class three- and four-colour printing, in particular catalogues, booklets, folders and publicity matter generally. For this reason all the new equipment has been chosen to handle four-colour work if required.

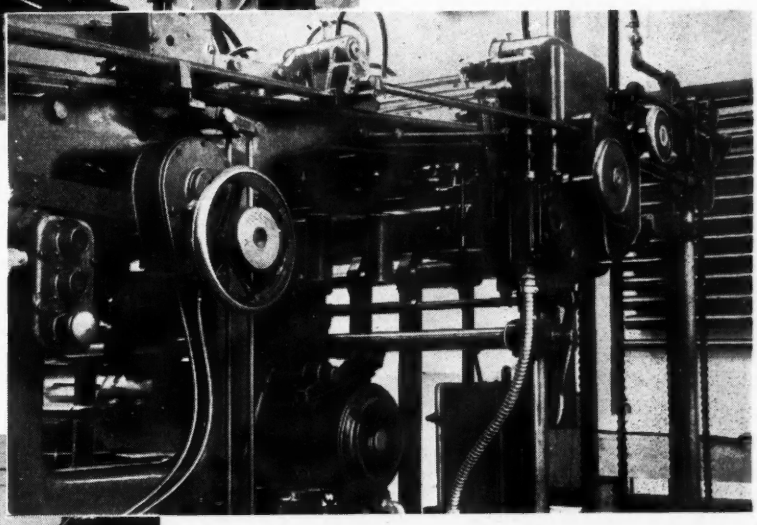
In accordance with modern practice the factory has been set out on a single floor, with a planned layout for the speedy handling of work and an uninterrupted continuity of production. Individual, direct electric drive is employed on all machines and there is no shafting. Much of the equipment is fully automatic and requires only the minimum of attention. One of the large high-speed letterpress machines is a two-revolution Miehle capable of a maximum output of 3,000 sheets

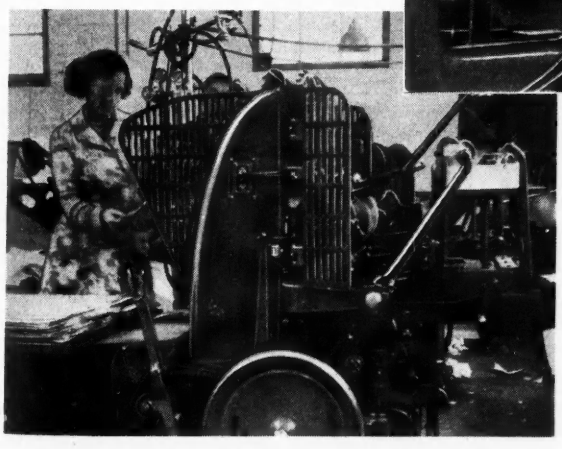
**"Perfecta" guillotine**



**Large Miehle two-revolution press, with (right) the push-button controls for the main driving motor and the Dexter automatic suction feed**

25 in. by 40 in. per hour. This is driven by a 6.3-HP, 1,300/650-RPM Holmes special commutator type, variable-speed motor and is provided with a Dexter automatic suction feed operated by a separate 2-HP, 1,425-RPM Meech motor. Both the main motor and that for the automatic feed are fitted with remote





**One of the small vertical Miehle presses**

control, and a mechanical tripping device stops the machine if the paper supply is interrupted. An extension delivery further speeds up production. To deal with the same class of work there is a smaller edition of this type of machine

capable of turning out 2,000 sheets, 20 in. by 30 in., per hour. To drive it a 3-HP, 1,420-RPM Higgs motor is used.

Another large two-revolution machine takes bigger sheets (30 in. by 40 in.), and is capable of printing 2,300 sheets per hour. A Holmes motor (4.2-HP, 1,440/1,720-RPM) fitted with remote control is used for driving it. As on all the machines mentioned, an inching button is provided and there is a separate automatic switch with overload release. If the the supply of paper stops, spring contacts come into operation, actuate a relay and switch off the motor. For safety a 20-V supply from a small transformers is employed for this circuit. Suction feed is provided.

For small sheets up to 13½ by 20 in. vertical Miehle machines are brought into service. As with the other apparatus, these can be used for any class of work but are especially suitable for high-class colour printing. A maximum of 4,500 prints an hour can be handled by each machine. Operation is by means of 2-HP, 1,420-RPM B.T.H. motors, which are also geared to suction pumps for the paper feed system. Push-button control is provided and speed regulation is effected by using different sets of pulleys.

In order to keep the printed sheets from smudging while the ink is still wet and to obviate the need for interleaving, A.T.F. non-offset solenoid-actuated spray guns are used to

impart a thin coat of resinous substance to the paper after printing. These spray guns are operated from an Air Industrial Development compressor.

The guillotines for cutting the sheets are fully automatic and equipped with push-button control. Motors of 3-HP are used in each case, the "Perfecta" model (A. Lakeman) having a 2,850-RPM unit and the "New Conqueror" (J. Greig & Sons) a 1,410-RPM motor. A Cleveland folding machine is fitted with a 1½-HP, 940-RPM induction motor, while two-wire stitching machines are driven by a 1-HP, 1,400-RPM motor. English Electric motors are employed for all this cutting and binding machinery.

The use of a general lighting system of high intensity throughout the factory makes local lighting unnecessary (except under the machine boards) and is found very satisfactory. In the composing room an illumination intensity of 35 ft.-candles at the working plane is obtained with Benjamin reflectors, which are also used in the binding department to provide 10 ft.-candles. To facilitate the matching of ink colours, daylight reflectors supplied by Baxter & Caunter, Ltd., have been installed in the machine department to give 14 ft.-candles.

The electricity supply (400 V, AC) is taken through the factory by means of a ring main which can be isolated at four points in the event of a breakdown. Provision has been made for a load of 400 A. The electrical contractors were the Peterborough General Electric Co., Ltd. We are indebted to Mr. F. S. Oram, director of Geo. C. Caster & Co., Ltd., and also to Mr. E. J. Hurd, manager of the works, for their assistance in the preparation of this article.

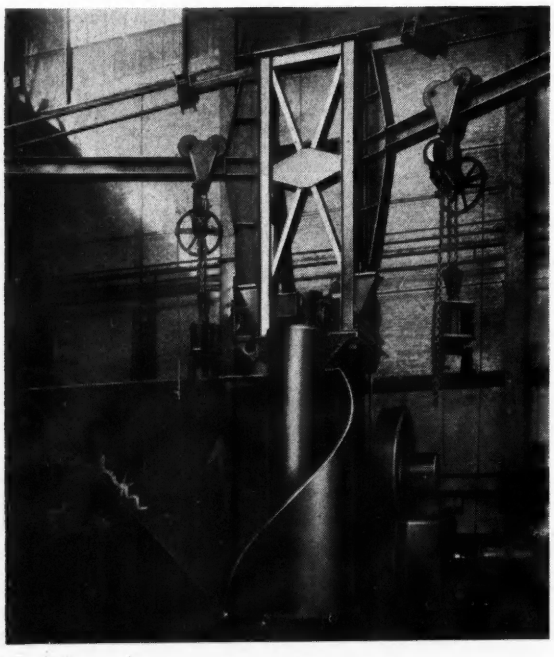
# Swiss Pipe-line

## Welded Spiral Joint Construction

THE hydro-electric power plant at Etzel in the Swiss canton of Schwytz uses a fall in the Sihl River. The water is led through a pressure gallery 2,940 metres long and a high-pressure pipe-line 2,200 m. long to a power house at Altendorf at the upper end of Lake Zurich. The drop is 483.3 m. (from 892.6 to 409.3 m.) and the catchment area of the artificial lake used as a reservoir is about 156 sq. km. The lake itself fills a flat, marshy valley, roughly 9 km. long and of an average width of 1.3 km. Its useful capacity is 91,600,000 cu. m.

When the power house is complete, water consumption will be at the rate of about 32 cu. m. per second, providing 176,000 HP. At present there are six vertical-shaft turbines of 20,000 HP each, generating at 10 kV, which is stepped up in an outdoor sub-station beside the power-house to 66 kV, single-phase, or 150 kV, three-phase.

The artificial lake is formed by a dam about 800 m. long across the south end of the Sihl valley. Beyond this, the valley is drained by trenches arranged to conduct water from higher land directly into the lake. Subsoil and surface water are drained off to a pumping plant, which raises it into the lake. At the west side of the lake a flat depression in the valley is filled by a dam, some 73 m. thick at the base and of 15 m. maximum height. It consists mainly of gravel. A third (masonry) dam is provided at the north end of the lake, and the water intakes are built in it.



**Forming a section of pipe**

The entrance to the intake pipe is protected by a grating with 30 mm. clear space between bars. A sluice gate is also provided at the entrance of the intake. From here a pipe, 50 m. long and 3,000 mm. in diameter, runs to the pressure gallery. A throttle valve is fitted in this pipe, which is also provided with branches permitting the Sihl River to be fed and the pressure gallery to be vented. One branch, with a capacity of 20 cu. m. per sec., serves for periodical flushing of the Sihl River bed, while the normal flow into the Sihl is a nominal minimum of 2.5 cu. m. per sec.

At the end of the pressure gallery there is a surge tank, beyond which the water is conducted in two pipes of 2,100 mm. diameter each, forming the actual high-pressure pipe-line. They are connected to a breeches pipe of 3,000 mm. diameter. The internal diameter of the high-pressure pipes decreases in steps of 50 mm. from the initial 2,100 mm. at the upper end to 1,800 mm. at the lower end, where they enter the power house.

Near their lower end the two high-pressure pipes separate, opening into a distribution pipe, formed as a closed ring around both sides of the power house, with an inside diameter varying from 1,500 mm. at its junction with the high-pressure pipe to 1,200 mm. From it, sixteen branches go to the turbines, each of 750 mm. inside diameter. The static pressure of the water at the surge tank is 3.5 atm. and at the distributing pipe it is 48 atm.

The high-pressure pipes, breeches pipe and branches are all of welded steel construction. The upper part of the pipe-line is of mild Siemens-Martin steel sheet, 17 to 36 mm. thick. Its tensile strength is 35 to 41 kg/mm², and the minimum elongation is 25 per cent. A novel feature of the pipe-line is the use of mild-steel plate for the lower part. The plate here has a tensile strength of 41 to 47 kg/mm² and 23 per cent. elongation. Instead of the usual longitudinal joints, these pipe sections are made up with spiral joints. Branches from the pipe are made with patented collar stiffenings, of a type developed by Sulzer Brothers during the past few years.

With pipes having a longitudinal welded seam, the joint is considered to have a strength of 0.85 per cent. of that of the full plate. The use of spiral joints, as has been shown by tests, gives the joint a strength equal to that of the full plate. Special care has to be taken in the welding, and the pipe sections are afterwards annealed to remove any strains which the welding might have introduced. Each section is tested to 1.5 times the service pressure before being installed. Sections of pipe are fitted together with the Sulzer muff testing joint.

For pipes made of plates up to 23 mm. thick the muffs were formed on a bending machine, but for pipe made of thicker plate they were machined on with a lathe. Test muffs are electrically welded, internally and externally. The pipes are not painted before being sent out; on arrival at the site they are sand blasted clean and then given a special oil primer coat, being finally bandaged with jute impregnated with hot bitumen. All the material for the line has been supplied by Sulzer Brothers, who also had the general contract for the erection.

## Illuminating High-voltage Lines

A SYSTEM of lighting high-voltage lines so as to render them visible as obstacles to peaceful aerial navigation has been patented by Claude, Paz & Silva in France. The principle of the system is to use a luminescent tube, one end of which is connected directly to one of the conductors, while the other end is connected to a wire suspended below the conductor by string insulators. Between the lamp and the wire an impedance is provided to stabilise the operation of the lamp. The wire is connected to the conductor from which it hangs through a suitable fixed condenser. This system, it is claimed, is not very expensive to operate, and provides complete assurance of visibility for towers or lines.

# INSTITUTION PROCEEDINGS

## Suppressing Electrical Fires. Mains Radio. Steam Turbine Nozzles

## Fire-Fighting Equipment

THE first meeting of the 1939-40 session of the Institution of Electrical Engineers in London was held on January 25th. The evening was devoted to a discussion of a report of the British Electrical and Allied Industries Research Association on fire fighting equipment for electrical installations, leading particulars of which were given in the ELECTRICAL REVIEW of January 19th.

The President (Mr. Johnstone Wright) stated that the E.R.A. had been requested by the Advisory Committee set up by the Electricity Commission in March, 1936, to consider what steps should be taken to reduce the risk of power station fires such as that which occurred at Bradford earlier in that year.

Mr. H. W. Swann (chairman, E.R.A. Fire Committee) remarked that at the outset precise knowledge was lacking as to the performance and suitability in particular locations of certain media for fighting fires. Valuable information was first obtained from large scale experiments that had been carried out in Paris, and then the County of London Electric Supply Co. provided facilities for creating artificial fires at Barking, and the manufacturers of fire-fighting media assisted at the tests carried out. Mr. R. A. McMahon then gave a summary of the Report, illustrated by colour films, which represented about 10 per cent. of 1¾ miles exposed.

Mr. H. Nimmo (Electricity Commission) suggested that the E.R.A. Report required amendment to bring it into line with the Electricity Commission Report. As a result of his investigations into fires at power stations, he considered that the use of portable apparatus called for a trained fire personnel. He saw no reason to change the views expressed in recommendations 45 and 46 in the Report of the Commissioners' Committee. The E.R.A. Report showed that the various media used in the tests could be successfully applied by expert representatives of the manufacturers, but it left the user wondering which system he ought to apply to his own installation. Water, properly applied, was in his view the most certain means of putting out any fire, and the cooling effect gave it a tremendous advantage over foam, $CO_2$, methyl bromide or carbon tetrachloride. The problem might be solved by using automatic atomised water installations for outdoor and indoor transformers and oil and bitumen filled switchgear, and ordinary water sprinklers for cable basements and places where oil was not likely to be present. He would prefer at least ten minutes' water supply in the storage tanks at, say, 60-lb. pressure, to the four or five minutes and 50-lb. suggested in the Report.

Mr. C. M. Kerr (London Fire Brigade and a member of the Sub-Committee) emphasised the importance of adequate back-up protection. Other important questions were the manner in which the various media would stand up to an explosion and the relative amount of maintenance necessary.

Dr. S. F. Barclay said that only if water were played on to burning oil with sufficient force to bring about emulsification was it effective in putting out intense fires, whereas the Report spoke only of putting out a fire by the cooling effect of water.

### Sensitive Smoke Detectors

Mr. G. O. McLean mentioned an installation of smoke detectors in a power station which gave indication two floors up of the smoke from a cigarette. He asked what depth of gravel pit was recommended for extinguishing burning transformer oil in the absence of drainage, and stated that 1 ft. was allowed in London power stations where space was limited.

Mr. R. W. L. Harris emphasised the fundamental importance of preventing the heating of the oil and advocated the application of complete protective systems to all zones to prevent sustained arcing and also the use of copper-covered and mineral-insulated cable for preventing trouble due to smouldering material.

Mr. D. H. Chisholm attributed the efficiency of water jets to their cooling effects. He believed that the value of the tests would have been increased if an electrical connection had been used to create fire and if a switch fire had been included.

Mr. G. Lambert said that although $CO_2$ did not extinguish by cooling so much as by blanketing, in five tests in which it was employed the average drop of temperature in the oil was 30 deg. F. Low visibility made it difficult to determine when the fire was out, but his experience was that this occurred when a characteristic dense cloud of $CO_2$ completely overwhelmed and filled the area of the fire risk. It was most difficult to plan the positioning of thermostats so that they were not sheltered. Although smoke detection was one of the fastest ways of detecting fires in their initial stages, he would hesitate to adopt it as a means of discharging an extinguishing agent because it might operate before there was any real necessity.

Mr. W. Dundas had known of fires in which dense smoke made it impossible to get at the fire with portable apparatus. Generally speaking, the equipment should be permanent and automatic. He deprecated the use of water for metal-clad switchgear because it might find its way inside. While not regarding gravel pits as necessary for draining away oil, they were certainly necessary to drain away the water used. Another important matter was the possibility of damage to the structure carrying the fire-fighting apparatus.

Mr. F. A. Sharpe regretted that the Report contained no recommendation as to how fire-fighting apparatus should be used. When a fire occurred, were they to turn on the media immediately and what were the precise operations to be carried out? He considered the risks of using gases to be preferable to the results of a serious fire. The adoption of smoke detection enabled prompt action to be taken which facilitated getting the various devices into operation.

Mr. F. B. Spicer stated that the photographs seemed to show that the water pipes closely surrounded the transformer whereas the gas pipes were considerably farther away.

Mr. H. Bright pointed out that in places of entertainment gases seemed to be ruled out because of their toxic or suffocating nature. The difficulty of draining oil from the transformers during a fire at such places seemed to call for a tank of sufficient capacity to hold the water as well as the overflowing oil. In his view, the only method of attack was by water automatically brought into play, but there was a danger of the oil floating on the surface of the water and eventually escaping into the building.

### Mr. Hacking's Reply

Mr. J. Hacking (chairman of the Sub-Committee) in the course of a brief reply to the discussion, to be amplified later in writing, said the Report contained no recommendation that portable apparatus should be employed, but it was felt that in certain installations it would be useful. Personally, he could not subscribe to the view that in all cases automatic installations should be used. Portable apparatus would be of great assistance if a fire should spread. He did not think there was any real difference between the recommendations of the Commissioners' Committee and of the E.R.A. Report. The E.R.A. Committee felt very strongly about having a sufficiently high pressure of water which gave a margin of safety, and therefore had recommended 50-lb. at the jets when all were in operation. In many cases the storage capacity required for the ten minutes advocated by Mr. Nimmo would be prohibitive and the tests did not seem to indicate the necessity for it. The word "emulsification" was not used, deliberately, because satisfactory results were obtained on another installation, using water, in which there was no question of emulsification. He was inclined to agree that the smoke detector should be used for detection and warning and not necessarily for the actual starting up of the automatic fire-fighting installation. The temperature drop of 30 deg. F. mentioned was not, in his opinion, due to the cooling effect of the $CO_2$.

## Handling Fuel Oil

METHODS of delivery, storage and handling "pool" fuel oils now being supplied by the direction of the Petroleum Board are described in a paper by Messrs. N. L. Hudson, R. J. Bressey and T. C. Bailey, which was presented to the Institute of Fuel in London on January 25th.

Price differences have provided an increased incentive to burn residual oils rather than distillates, together with a new inducement to burn heavier oils as fuel. These are viscous at normal atmospheric temperatures and so need to be heated in the storage tanks and pipe lines to enable them to be piped satisfactorily and atomised easily in the burners. According to the authors the cheapest method is by "waste" heat, followed by steam or hot water and electricity. They recommend that electric immersion heaters should have a protective covering of corrosion-resisting material, and the heating elements should be easily removable for renewals or repairs. They should be fitted in such a position that the heating element is always completely covered with oil, *i.e.*, below the level of the oil outlet pipe. The maximum rating of an immersion heater is based upon the oil consumption and the required rise in temperature in a given time. The wattage density should be kept as low as possible, preferably not exceeding 10 W per sq. in. of heating element.

Where electric heaters are installed for maintaining the oil temperature at the burners, it is preferable for these heaters to have thermostatic controls, and in all cases it is essential to fit a safety device, in the form of a fusible plug, to switch off in the event of overheating.

The principles enumerated by the authors are illustrated by lay-out diagrams, showing storage tanks, piping, motor-driven pumps, heaters and boiler burners, for conversion from light to heavy oil, together with recommended modification data in tabulated form.

## Radio Over Electricity Mains

THE relaying of broadcast radio programmes over electricity distributing mains, and the advantages claimed for that system over other wired-wireless methods, were the subjects of a lecture that was delivered by Capt. P. P. Eckersley (R. M. Radio, Ltd.) to the London Local Technical Group of the Electrical Power Engineers Association on January 23rd.

For house-to-house rediffusion by overhead wires specially erected for the purpose, a central receiver in charge of skilled engineers might cost £1,000; it would be economic if 10,000 people could be served at 1s. 6d. each weekly. In Holland there was a four-programme service using eight wires, which Capt. Eckersley thought was clumsy, unsightly and involved a good deal of money; yet experience had shown that, even so, it was profitable. In Hull householders willingly paid 1s. 6d. per week for the choice of two programmes. Capt. Eckersley thought the reason was that people tired of the trouble and expense involved in keeping their own wireless receivers in good working order.

The original company (with which Capt. Eckersley was no longer connected) which secured concessions in a few large towns for putting the scheme into operation was now worth £1,000,000. Local authorities which had opposed the "festooning" of houses with wires were prepared to reconsider their attitude when concession fees of the order of £10,000 were mentioned.

The system had appealed to the public and had done extremely well, but it was not ideal. Many advantages were to be derived from superimposing 20,000-cycle signals on the existing networks of 50-cycle electricity distribution mains. A terminal filter to allow the passage of high-frequency and reject low-frequency currents would permit a reproducer to be plugged into an electric lighting socket. By superimposing further signals at multiples of 15,000 cycles it would be possible to provide a range of radio programmes at low cost and with absolute reliability.

### Use of Lead Sheath

Capt. Eckersley briefly described how by using a four-core lead-sheathed distributor he had proved by tests in Liverpool and on the Northmet system that if the high-frequency circuit were through the copper core and back through the lead sheath there would be no variation of voltage on the distributor, because the high-frequency voltages would be in phase over all the conductors. He claimed that such a system eliminated noise and was entirely independent of load. Tests had been made in which variations of load did not alter the signal voltage by more than one per cent. The basic conception was the use of the lead sheath of the conductor.

After explaining how certain technical difficulties had been overcome, Capt. Eckersley said that for a whole town with probably 50 or 100 sub-stations it would be too expensive to have high-frequency apparatus in each sub-station. It was proposed to have this apparatus outside the town and to pass the high-frequency currents through the supply system, making use of the existing pilot wires or telephone wires, or installing such wires where necessary, to avoid difficulties at points of interconnection of the sub-stations. For the most part difficulties had been overcome, although special difficulties attached to overhead line systems.

In conclusion, Capt. Eckersley said he was extremely grateful for the support that had been given to him by the electricity supply industry. Just before the war there was sudden bureaucratic keenness to get the idea adopted, but when war broke out it was said to be better not to go ahead and regret was actually expressed that it had not been put into operation two years ago! In America £1,250,000 had been spent on a similar system, but it had not yet been got going because the technology was not right. In this country £50,000 had been spent in face of a great deal of discouragement. He believed this scheme would be put into use, but it was quite probable that by the time it was started on a large scale all the patents would have run out.

In answer to Mr. G. W. S. Sichel he said he did not want to touch high-voltage networks; putting radio transmissions through power transformers was out of court.

Mr. H. P. Parker, remarking that he had no interest either technically or commercially in this field, disagreed that existing wireless receivers were unreliable and costly to maintain. Radio diffusion through power networks could be shown to work, but was inherently full of vice and trouble. That view was based on a fairly lengthy experience of transmission of audio-frequency and high-frequency signals over power networks. It would involve the use of power factor correction condensers and all sorts of "nasty" things from the point of view of the high-frequency engineer. Those who had been using cable sheaths as a return for superimposed frequencies had found some difficulties, the principal being that although, ostensibly, the neutral was earthed only at one point, actually it was earthed in every other house.

Capt. Eckersley replied that as the result of his experiments he had come to the conclusion that the system would work, not on all networks or under all conditions, but on a sufficient number of networks to make it commercial.

Replying to the chairman (Mr. A. H. Bennett, Northmet Power Co.) as to how it was proposed to get over the non-metallic return in the case of overhead line networks, he said the solution was to install separate wires.

In reply to a question put by himself, Capt. Eckersley was told that undertakings in this country which had bonded earths and those which had not, were in about equal proportions.

## Turbine Nozzle Efficiency

SOME researches into steam turbine nozzle efficiency formed the subject of the Sir Charles Parsons Memorial Lecture for 1939 which has been prepared by Dr. H. L. Guy (chief engineer, mechanical department, Metropolitan-Vickers Electrical Co., Ltd.) and issued by the Institution of Mechanical Engineers.

The probable cause of the anomalous results sometimes obtained during the Institution's investigations (six reports were published between 1923 and 1930) was the distance of the nozzle face from the impact plate. The lecturer now shows how since then there have been devised means of measuring more accurately the direction of flow in different parts of the steam from the nozzle and at distances as close to its outlet face as is usual to the entry of the associated moving blade.

The publication of the first results was sensational, because it appeared to establish a shape of characteristic for the variation in velocity-coefficient of a nozzle with velocity of the steam which was markedly different from conceptions then currently held.

The most important characteristic curve was that for a throat-length of 0/1 for those researches soon established that long throats were a source of undue loss, and their use was generally abandoned. Attempts to base designs on the earlier test deductions were disappointing in efficiency and their re-examination with later information suggests that, while the true characteristic of certain types of nozzles may be of wave form, the actual rise and fall of efficiency with velocity (particularly at low velocities) is much less than at first suggested.

Consideration of results obtained by more recent methods of experimental attack as used by the author indicates that the form of the characteristic is susceptible to modification by design, and that for each limited range of steam-velocity there is a type of characteristic which gives the best result. In the main this group of curves falls into two classes. The one has a characteristic which, with increasing velocity, either falls continuously or else falls to a valley at a moderate velocity, thereafter rising very slowly. The other rises continuously with increasing velocity to a maximum and thereafter falls with further increase in velocity.

## Protecting Large Alternators

THE protection of large alternators was the subject of a paper by Mr. S. D. Thorp which was read before the London Students' Section of the Institution of Electrical Engineers on January 24th. While it was desirable that the choice of the best system should be left to the specialist, the criteria governing that choice should be known, said the author, who proceeded to detail the requirements, types of fault and available means of protection. Choice of fault setting, testing and maintenance also received consideration.

The average relative cost of protective gear for fully protected machines against the cost of the electrical plant it protected was approximately 6 per cent. for machines of from 2·5 MVA and one per cent. for larger machines. These figures were based on the cost of the generator and exciter and did not take into account the cost of the boilers, turbine and auxiliary equipment. In the event of a bad fault on an unprotected machine, it would probably be necessary to replace the complete stator winding, the stator core and perhaps the rotor winding, the damage amounting to as much as 30 per cent. of the cost of a new machine.

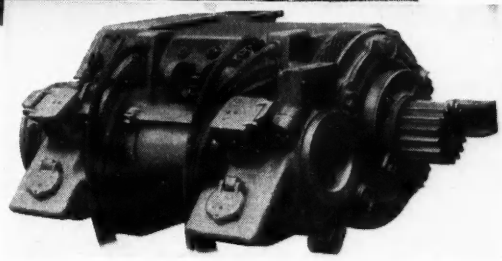
# NEW L.M.S. ROLLING STOCK

## Liverpool-Southport Line Improvements

TO replace obsolescent saloon stock on the electrified lines between Liverpool and Southport new trains are being constructed in the Derby Carriage and Wagon Works of the L.M.S. Railway. The coach work is being produced to the designs and under the supervision of the chief mechanical engineer, Mr. W. A. Stanier, and the electrical equipment installed to the specification and requirements of Mr. C. E. Fairburn, deputy chief mechanical engineer and chief electrical engineer. The contractors for electrical equipment are the English Electric Co., Ltd.

Thirty-four three-car units are being produced, each comprising a motor car, third-class trailer car, and composite driving trailer, while in addition, twenty-five two-car units are to be provided each comprising a motor car and non-driving trailer, of which sixteen have third-class trailer cars and nine have composite trailers. These two-car units will be used in conjunction with the three-car units so that trains may be made up of three, four, five, or six cars.

A schedule speed of about 30 MPH will be maintained by a fully loaded train on the stopping service with stations 1.23 miles apart, allowing 20 sec. for stops. To meet the express services, the maximum speed of a fully loaded train is over 70 MPH. Each motor car is fitted with four axle-hung self-ventilated motors having a one-hour rating of 235 HP and a continuous rating of 184 HP at 580 V. In the design of the traction motor, particular attention has been given to reduction of weight. The weight of a motor complete with gear case, gear wheel and pinion is 4,484 lb.



**A new three-car set, type of motor employed, and the interior of a first-class coach showing the illumination complying with the lighting regulations**

There are two separate control equipments for each motor car, each set controlling one pair of motors. Each equipment consists of 19 electro-pneumatic contactors, two of which are fitted with extended arc chutes and act as line switches. Power is taken from a bus line fed by third rail collector shoes on motor coaches and driving trailers.

A feature in the control is that both the main and interlock contacts are at the front of the contactor. A lever enables the magnet valve to be operated from the front so that all inspection can be carried out from one side. Another example of the attention given to ease of maintenance is that all the main cases are so mounted on the underframe that they can be very easily removed from the coach and replaced. The supply for the control circuits is provided by a 52-V m.g. set and an alkaline battery of 36 cells.

In order to obtain smooth acceleration and to get full advantage of adhesive weight on the motored axles, particular attention has been paid to the design of the current limit relay, which is of the balanced armature type and is, therefore, not affected by vibration or train movement.

Compressed air for brakes, electro-pneumatic control and air-operated doors is provided by a two-cylinder air compressor directly driven from a 600-V motor. This motor is controlled in the ordinary way by a compressor-governor, a synchronising wire being used to ensure that the compressors of a train operate simultaneously. One compressor is fitted to each motor car.

The coach heaters are also supplied at 600 V and the heating contactor is controlled by a thermostat. Electricity for coach lighting is supplied through an electro-magnetic contactor controlled by a set and trip switch in the guard's van. The new trains are turned out of the shops fully equipped to meet the lighting restrictions of the Minister of Transport. Direct lighting is cut off at a line about 4 in. to 8 in. below the bottom of the windows. Special shades are fitted to lamps near the entrances. Cylindrical shades are normally fitted, but where the lights are positioned near luggage racks, a special bulkhead type fitting is used.

## London Electricity Charges

ON January 24th Sir W. Davison asked the Minister of Transport if he was aware that the Central London Electricity Company was raising its fixed quarterly charges under the commercial two-part tariff by practically 100 per cent.; and whether he could take any action to secure more reasonable treatment to consumers.

Captain Wallace said he had asked the Electricity Commissioners to let him have a full report on the increased charges by the Central London Electricity, Ltd., and he hoped to receive that report very shortly.

Sir W. Davison asked if the Government recognised how hard it was that people who were remaining in London on national service and other important business should have to bear this heavy increase in electricity charges largely by reason of the Government's evacuation policy. Capt. Wallace said that he preferred to wait for the report from the Electricity Commissioners before making any pronouncement.

Mr. Lyons asked whether the increased charges would be levied before his reception of the report. Capt. Wallace said that the company had given notice that the charges would be levied in the fourth quarter, which he gathered was the first quarter of this year.

Mr. H. Morrison asked if Capt. Wallace could give an assurance that if it was established *prima facie* that the charges were excessive he would exercise all the power that he had to reduce them, or if necessary bring in legislation to stop this profiteering. Capt. Wallace said that he had no power in normal circumstances to deal with charges which were within the statutory maxima. He had power under the Defence Regulations and if on receipt of the report it appeared to him that there was justification for intervention on his part he would, naturally, seriously consider in what way he could deal with it.

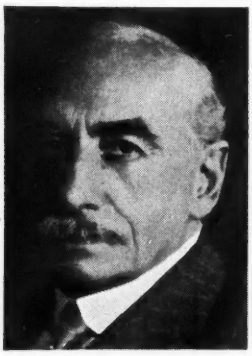
Mr. Keeling asked whether, when the Minister received the report, he would consider if such increase would be justified if electricity were subject to the Prices of Goods Act. Capt. Wallace said that that was one of the things he would have to consider.

# PERSONAL AND SOCIAL

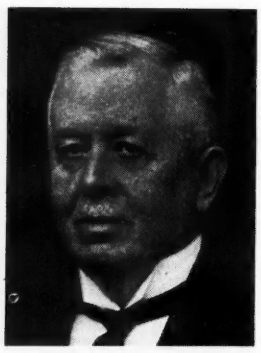
## Information regarding new appointments and other matters of interest for this page are welcomed

FOLLOWING a suggested reorganisation of the technical staff the Chichester Electricity Committee has adopted the N.J.B. schedule of salaries from January 1st. The undertaking comes into "Class D" and members of the technical staff are now graded as follows: Mains superintendent (Grade 5): Mr. A. R. Walter (Mr. Walter was due to retire in March, but in view of the present situation it was proposed to continue his services for a further year). Assistant mains engineers (Grade 7): Messrs. E. Hawkins and L. C. Cooper. Assistant mains engineer (Grade 8a): Mr. A. R. Humphrey (the assistant mains engineers had hitherto been designated "district engineers," but following the reorganisation necessitating a centralised administration it was decided to introduce a rearrangement). Installation engineer (Grade 8a): Mr. R. W. Hunter. (The position of installation engineer is a new appointment as Mr. Hunter had previously been jointly responsible for the consumers' and meter sections, but is now in full charge of these departments.)

The Council of the Institution of Electrical Engineers has elected **Mr. Roger T. Smith,** B.Sc.(Lond.), M.Inst.C.E., M.I.Mech.E., M.I.E.E., M.Inst.T., a past-president, to be an honorary member of the Institution. From 1890 to 1893 Mr. Smith was engineer and representative in India for Easton,



**Mr. Roger T. Smith**



**Dr. Alexander Russell**

Anderson & Goolden, erecting and maintaining water and sewage works pumping machinery. He returned to this country in 1894 as a resident engineer at Davies Street generating station, London, but a year later went to Belgium to take up the appointment of technical manager of the Cie Hydro-Electrique Anversoise, supplying electricity to Antwerp. In 1898 he became assistant in the consulting firm of Sir Alex. Kennedy & Jenkin, and in 1905 was appointed electrical engineer to the Great Western Railway, a position which he held until 1924, when he went into partnership with the consulting engineering firm of Highfield & Roger Smith. For three years Mr. Smith was a consulting engineer to the Construction Electriques de France, and he reported with Sir Felix Pole on the Sudan Government Railways and Steamers.

The Council of the Institution has also awarded the Faraday Medal to **Dr. Alexander Russell,** M.A., D.Sc., LL.D., F.R.S., an honorary member and a past-president. Dr. Russell was lecturer at Caius College, Cheltenham College, and Oxford Military College before he became associated with Faraday House in 1889, when he was appointed senior lecturer. He became principal in 1909, governor in 1921, and advisory principal in 1937. He retired from Faraday House last year, when presentations were made to him, contributed by old students from all over the world. Dr. Russell was president of the Physical Society from 1922-24, a member of the general board of the National Physical Laboratory from 1928-30, and was on the National Committee for Scientific Radio from 1932-39. He also served on the National Committee for Physics from 1924-30, and is examiner to Glasgow, Aberdeen, Cambridge, and London Universities.

The Minister of Transport has appointed **Lord Barnby,** C.M.G., C.B.E., M.V.O. (formerly Col. the Hon. Vernon Willey), to be a member of the Central Electricity Board, in place of **Sir Andrew Duncan,** G.B.E., who has resigned his membership of the Board on his appointment as President of the Board of Trade. Lord Barnby was previously a member of the Board from 1927 until 1935.

**Mr. H. Broadbent,** an assistant in the mains section of the Bingley Urban District Council's Electricity Department, was married to Miss Margaret Stocks, of Crosland Moor, Huddersfield, on January 17th.

**Mr. R. P. Beddow** has been appointed secretary to the British Electric Traction Co., Ltd., to fill the vacancy caused by the recent retirement of Mr. T. Bower.

The Surrey County Committee of the Electrical Industries Benevolent Association held its annual meeting and lunch at the Burford Bridge Hotel, Dorking, on January 18th. **Mr. F. Woods,** the retiring chairman, spoke of the satisfactory results obtained and the good work of the E.I.B.A. The following were unanimously elected: President, Sir Montague Hughman; vice-presidents, Messrs. A. E. McKenzie, F. W. Purse, J. C. Dalton, F. N. Rendell-Baker, A. Raworth and M. V. Ely; chairman, Mr. E. J. Jarvis; and hon. secretary, Mr. C. Rowbotham. The meeting accorded a hearty vote of thanks to Mr. F. Woods and Mr. C. Rowbotham for their services since the Committee's inception. The lunch was attended by more than forty supporters and in proposing the toast of E.I.B.A. Mr. C. Rowbotham stressed the desirability of obtaining small contributions from eligible members of the industry. Mr. A. E. McKenzie replied to this toast in his inimitable manner and stated his personal experience of a case where the E.I.B.A. had rendered relief. Mr. F. Woods, proposing the toast of the visitors, thanked those present for their support of such a worthy cause.

**Mr. M. J. Rosekilly** informs us that Government control of aluminium for domestic purposes has necessitated the severing of his many years' connection with Corfield-Sigg, Ltd., as director and general manager. On behalf of the sales staff and himself, he wishes to thank those who have given their support and assistance in making business relations so cordial, and he trusts that they may be resumed again in the future. His address is 11, Barrowfield Drive, Hove, 4.

Stoke-on-Trent Corporation Electricity Committee has considered questions relating to the positions of chief engineer and commercial assistant in view of the fact that **Mr. C. H. Yeaman** will shortly be retiring on superannuation, and recommends that the appointment of a chief engineer should be postponed for the present and that the duties of the office should be carried out so far as the engineering work is concerned by **Mr. H. L. Mills,** and the commercial work by **Mr. T. Lockett,** and that the salary of Mr. Mills should be £1,000 per annum, and of Mr. Lockett £550 per annum.

**Sir Louis Sterling,** vice-chairman and managing director of A. C. Cossor, Ltd., has joined the board of Sterling Batteries, Ltd., in the place of Mr. J. H. Thomas who has resigned.

Officials elected at the second annual meeting of the Norwich and District E.D.A. Circle, held recently, were: Chairman, Mr. Philip A. Bailey; vice-chairman, Mr. C. J. Morse; honorary secretary, Mr. A. C. Green; honorary treasurer, Mr. A. R. Pank; and a committee consisting of Messrs. A. H. Brown, G. A. Lee, H. Lyon, R. W. Steel, and H. P. Walker.

**Commdr. F. J. D. Campbell Allen,** R.N., who is interested in the formation of a naval base sports club, tells us that the Club is in need of radio receiving sets which are required both for the men in temporary wooden huts and for those serving in the patrol and minesweeping flotillas. He suggests that some of our readers who have bought new sets may have their old sets which they can spare. These, either battery or DC, would be welcomed. They can be sent to Commdr. Allen's office, c/o Bastian & Allen, Ltd., 24, Bedford Square, W.C.1.

**Mr. Herbert Bridge** has been appointed a director of Thomas De La Rue & Co.

**Brigadier-General Wade H. Hayes** has been appointed chairman of the Cornwall Electric Power Co., the Urban Electric Supply Co., Ltd., and the East Anglian Electric Supply Co., Ltd.

## Obituary

**Mr. A. B. Robertson.**—The death occurred on January 24th, at the age of sixty-two, of Mr. A. B. Robertson, head of A. B. Robertson & Son, Ltd., electrical engineers and plumbers, of Aberdeen. Mr. Robertson was one of the leading electrical contractors in Northern Scotland. He served his apprenticeship as an electrical engineer with his father, Mr. A. B. Robertson, the founder of the firm, and subsequently went to London. On his return to Aberdeen he entered into partnership with his father in the firm of A. B. Robertson & Son. He was a member of the I.E.E.

**Mr. B. D. Porritt.**—The death occurred on January 28th of Mr. B. D. Porritt, M.Sc.(Lond.), Director of Research, Research Association of Rubber Manufacturers, at the age of fifty-six.

**Prof. R. Beattie.**—The death is announced of Mr. Robert Beattie, Emeritus Professor of Electrotechnics at Manchester University, which occurred on January 25th. He was connected with Manchester University for over forty years, relinquishing his appointment in 1938.

**Will.—Sir Bernard Greenwell, Bt.,** chairman of the County of London Electric Supply Co., Ltd., and chairman or a director of its subsidiary companies, left £667,793 with net personalty £524,986.

# CORRESPONDENCE

***Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions***

### Salaries in the Supply Industry

WILL you allow me space to voice an opinion regarding the solution of the present unsatisfactory position disclosed in your advertisement columns anent chief engineers' appointments?

First, I would stress that the principal sufferers in the present circumstances are the loyal and conscientious engineers who refrain from making applications, though fully qualified, and who would gain an increased salary and status if they ignored the ban. The solution, I suggest, is in the revision of the N.J.B. schedule so that there is not the enormous gap as at present, between the salaries of chief engineers and their deputies and assistants.

The parsimonious municipalities are simply reducing the gap by bringing down chief engineers' salaries, but if the gap were reduced from the other end they couldn't adopt such tactics. If the chiefs (A.M.E.E.) would only support their juniors (E.P.E.A.) in such a revision, they would be safeguarding their own scheduled salaries.

I enclose my card but in the circumstances prefer to subscribe myself, A LOYAL DEPUTY.

*January 27th.*

### Prices and the Consumer

Your editorial note stating that the action of the Association of Non-Statutory Electricity Suppliers in not raising their tariffs was meritorious might well pass without comment other than praise.

These non-statutory undertakers have much in common with the early pioneers who laid the stepping stones towards the strength of the electrical industry as it exists to-day. They have been, as an author said, the people who get up in the morning when the rest of the house is asleep and rattle the fire-irons in order that the slumbering ones shall sit up and take notice.

It may seem odd if the Association has suggested consultation with consumers regarding a rise in charges but it should be remembered that these small undertakings have been built up by personal contact with their consumers where orthodox routine would have failed, so perhaps that is why they take this view.

They have tilled the hard barren ground where the more able either feared or omitted to tread, unlike the grid scheme which has merely built its house upon someone else's foundations. Any fool can make his wares seen in the busy square but it requires a genius to stand in the wilderness and draw the people together by only his single merit.

Overton, ARCHIE GAMBLE,
*January 27th.* Overton District Electricity Works.

### New Terms Needed

The provision of suitable technical terms to fit in with practice is more than a luxury, it is a necessary part of the art of engineering. Consider the words "counter-clockwise" and "clockwise" to denote vector rotation; they are so gauche and inconvenient that they should be replaced and the obvious words to replace them are "left turn" and "right turn," words which already have the required meaning in the army. We also speak of left- and right-handed screws. To this one may add the method of denoting the rotation of a vector by a single barb for the head, a barb on the left side indicating right-turn rotation. Two barbs would indicate rotation at double the speed. I endeavoured to interest Silvanus Thompson in this method, but he was out of health at the time. It would, nevertheless, be a great convenience if put into use.

A word is required for oil-break switches with small oil content. "Oil-poor" is not good, it implies that there is insufficient oil for the purpose. "Switches with low oil content" is too long. Probably the term "oilette switch" would fill requirements, the meaning is clear and the word is not unpleasing.

The term lightning arrestor is another absurdity. One does not try to arrest lightning but to let it escape without doing harm. It is like the safety valve on a boiler which blows off excess pressure. Probably the words "lightning escape valve," or more shortly "lightning valve," or "divertor," would fill requirements. May I recall that I introduced the words "capacitor" and "capacitate" through the ELECTRICAL REVIEW of April 11th, 1924? These words did not come into use here until they had been used in the United States for many years. May one hope that the above words may have a more speedy success.

Tynemouth, *January 22nd.* C. TURNBULL.

### Electrical Thawing

The thawing-out of frozen water services has been very effectively dealt with by the use of a 3-kVA double-wound single-phase transformer, ratio 230/12, with a regulating resistance on the primary side and ammeter scaled 0-250 on the secondary side. The primary is plugged into a 15-A radiator socket and the secondary leads attached to a tap or pipe inside the house and to the stop cock of a neighbouring house. The regulating resistance is adjusted so that the secondary current flows through the frozen pipe at about 150 A. The normal ½-in. lead service pipe thaws out in 5 to 7 minutes.

In cases of sickness where there is no water supply and consequently no kitchen fire or other means of providing hot water this remedy has been much appreciated.

Carlisle, *January 29th.* C. W. SALT,
*City Electrical Engineer.*

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# In the Courts

### Internally Frosted Lamp Patent

IN the Chancery Division on January 24th the hearing was commenced before Mr. Justice Bennett of an action by the British Thomson-Houston Co., Ltd., against Tungstalite, Ltd., for the alleged infringement of plaintiffs' letters patent No. 228907 for improvements in or relating to frosted glass articles and the method of making them.

The defendants by way of defence pleaded prior publication and prior general common knowledge; that the patent did not disclose the improvement of a new manufacture by the specification; and that it did not clearly and sufficiently state the scope of the manufacture. The defendants also claimed the revocation of the plaintiffs' letters patent.

Mr. Trevor Watson, K.C., in opening the plaintiffs' case, said the action was for infringement of letters patent in which the usual relief was claimed. There had been a large number of experiments carried out on both sides under the order of the Court and under the supervision of representatives of both sides. The action concerned gasfilled electric lamps made in accordance with the plaintiffs' patent. The defendants had, it was alleged, made lamps which were identical and it was the major controversy whether they were made by an infringing process. Defendants denied infringement and pleaded that there was a lack of novelty in the plaintiffs' alleged invention and want of subject matter. Defendants further pleaded insufficiency of description in the patent and also inutility. Defendants further said that the plaintiffs had obtained their letters patent on a false statement or representation. Mr. Trevor Watson dealt at great length with the plaintiffs' specification and the issues involved in the defences raised, and stated that the infringements alleged included that which related to the frosting of the interiors of electric light bulbs.

It was agreed that at some time His Lordship should go to the defendants' works to witness certain experiments there.

The case was still proceeding when we went to press.

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## Wages During Illness

Before Mr. Justice Atkinson in the King's Bench Division on January 26th Mr. Frank Sidney Broom, of 5, Newcomen Road, Battersea, brought an action against his former employers, Messrs. Simmonds & Stokes, Ltd., electrical engineers and manufacturers, claiming £22 10s. wages alleged to be due and owing to him during a period of illness.

Counsel stated that the sum claimed represented nine weeks' wages at £2 10s. a week from December 28th, 1936, to February 28th, 1937. Mr. Broom, who was employed as a handyman at the defendants' factory, was ill during this period.

The defence was a denial of any indebtedness to Mr. Broom, it being contended that he had been employed on an hourly basis. It was an express or implied term of the contract of employment that Mr. Broom would be entitled to wages for each hour actually worked by him at 1s. 0¾d. per hour.

Mr. Justice Atkinson, giving judgment, said he accepted evidence given for the defence with regard to the practice in the industry and that employees of this particular firm were paid on an hourly basis. In the circumstances Mr. Broom's action could not succeed and there must be judgment for the defendants. Judgment was accordingly entered for Messrs. Simmonds & Stokes, Ltd., with costs.

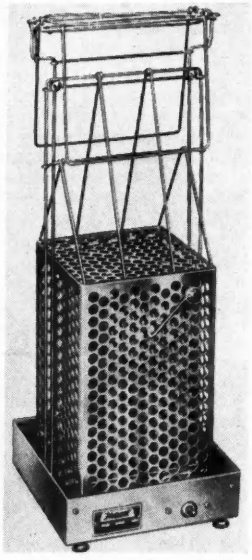
# NEW ELECTRICAL PRODUCTS

## A Review of Equipment Recently Marketed

### Clothes Dryer and Airer

A COMBINED electric clothes dryer and airer made by the HOTPOINT ELECTRIC APPLIANCE CO., LTD., 24, Newman Street, London, W.1, should appeal particularly to flat dwellers and should also prove of great use in small hotels, nursing homes, clinics, schools, hairdressing saloons, etc., where the quick drying of small quantities of garments or articles is a necessity.

The device consists of a perforated metal box in which are located two 750-W heating elements. Hinged arms fitted to a telescopic framework for supporting the garments to be dried fold neatly away, and in its closed position the dryer is only 2 ft. 6 in. high and approximately 1 ft. square at the base. With the framework fully extended, the total height is 4 ft. It is extremely light and easy to handle, is absolutely safe, and can be easily stowed away when not in use.

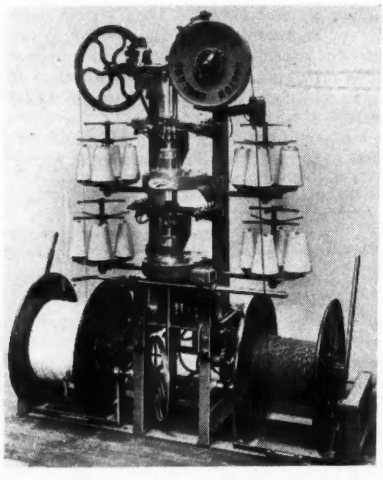


**Hotpoint clothes dryer and airer**

A perforated heat spreader, operated by a handle on the box in its horizontal position, allows the heat to warm the sides of the metal box for drying the hems of garments. When the hems are dry, the spreader is brought into a vertical position, which allows more heat to ascend to the top of the garments. In actual use, the wet clothes are surrounded by a gingham enclosing cover with a zip fastener, thus ensuring that dry heat is kept where it is needed.

### Core-covering Machine

Exceptionally fast production is possible with the new "Braidex" non-ballooning, high duty, two-way, core-covering machine produced by B. & F. CARTER & CO., LTD., Albion Works, Waterloo Street, Bolton, for v.i.r., aerial, telephone, flexible and other cables. Using No. 40 single ends cotton yarn when covering 3/.029 vulcanised india-rubber cable at 14 stitches per inch, it is possible to deal with 720 ft. an hour, which is claimed to be more than four times as fast as one of the fastest braiding machines and at the same time to effect a considerable saving in yarn.



**Carter's "Braidex" core-covering machine**

The machine puts two distinct knitted tubular envelopes or sheaths over the wire. The heads are arranged coaxially, one immediately over the other, the core passing through one head and then immediately through the other. The inner envelope is knitted by the upper head, which rotates in a clockwise direction, while the outer envelope is provided by the lower head rotating anti-clockwise. The cams and creel-holders are stationary Tension on the yarn can be varied while the machine is running, enabling the sheath to be made very tight on the core. The creel holds sufficient cotton to run the machine for approximately 23 hours.

The unit is self-contained and is driven by an electric motor operated by push-button controls. Automatic electric controls are provided so that should an end break, the yarn supply, conductor or core run out, or the stitching become loose, the machine stops almost instantaneously without any overrunning, there being no visible evidence to show a piecing-up. Very little floor space is required, as these machines can be installed back to back.

### Carved Table Lamps

Table lamps depicting bears, cats and other figures, are novelties available from KANDEM ELECTRICAL, LTD., 711 & 715, Fulham Road, London, S.W.6. The figures are hand carved from Spanish chestnut and are supplied complete with push-bar lampholder, six feet of flex and a plug.

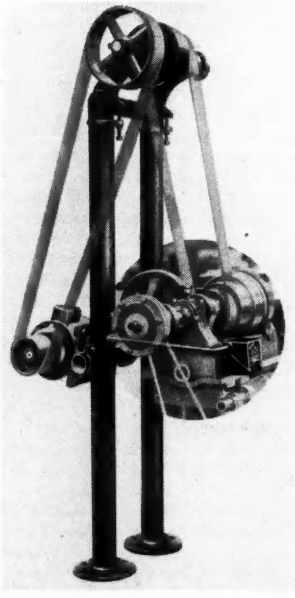
**Kandem carved table lamps**

### White Fluorescent Tubes

The new white "Osira" fluorescent tubes introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2., represent the ideal medium for showcase lighting, possessing a high efficiency (three or four times that of the lamps normally used for showcase lighting) with a corresponding reduction in electricity consumption. This is a matter of considerable importance in view of the long hours during which showcase lighting is in use. Furthermore, the heat produced in a showcase equipped with tungsten lamps is, for equal illumination, approximately three times as great as in one equipped with this fluorescent tubing. Another advantage of fluorescent tubing is the absence of radiant heat which frequently causes local heat spots in showcases equipped with tungsten lighting, while its long life materially reduces maintenance charges. As the light given by the tubes is very close to north sky daylight it is ideal for coloured displays.

### A Self-contained Power Unit

A self-contained motorised unit, designed to drive any cone-pulley machine and to operate by electric push-button control, has recently been introduced by NEWMAN INDUSTRIES, LTD., Yate, Bristol. It comprises a frame of twin-steel tubular pillars surmounted by steel bearing brackets which carry the ball-bearing countershaft and cone pulley. These pillars are secured by a horizontal cross-member, the whole being welded together to form an elongated H shape upright frame. Anchorage points are provided by flanged feet and by a bar extending from the horizontal cross member to a convenient fixing point on the machine.

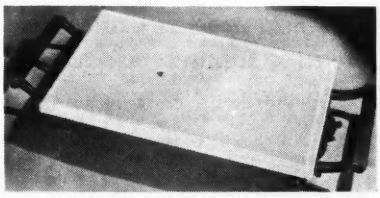


**Newman motorised unit**

A Newman totally enclosed fan-cooled three-phase, 50-cycle motor, which develops a high starting torque is fixed to a swivel platform mounted on the cross member, at approximately 3 ft. above floor level. The primary belt is adjusted by swivelling the motor on the cross member, and the secondary belt by two set screws raising or lowering the bearing brackets. Push-button control is fitted on the front of the machine to be driven immediately adjacent the operator's hand.

## Controlled-Heat Hotplate

By the incorporation of thermostatic control in the new hotplate made by H.M.V. HOUSEHOLD APPLIANCES, Bournesbridge, Hayes, Middlesex, the temperature is kept constant, foods cannot be burnt and a low consumption of electricity is ensured. The apparatus heats up quickly and the heat is evenly distributed over the whole surface. It is impossible to scorch the table and felt-covered feet obviate any possibility of damage to polished surfaces. Stain-resisting primrose vitreous porcelain is the standard finish, and heat-insulating black bakelite handles are fitted. An off/on switch is provided. Models suitable for either AC or DC are available.



**H.M.V. controlled-heat hotplate**

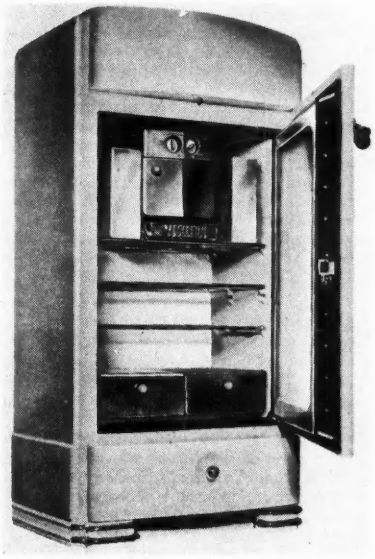
## A.R.P. Refrigerator

A "Coldspot" refrigerator specially designed for A.R.P. purposes has recently been placed on the market by SEARS, ROEBUCK & Co., LTD., Wembley.

In the event of a failure of the electricity supply at least four days' reserve storage is provided by means of two ice reservoirs.

The special accessories which are supplied include two glass water bottles, two porcelain containers for vegetables, a large bin for general storage and two dishes for containing butter, &c.

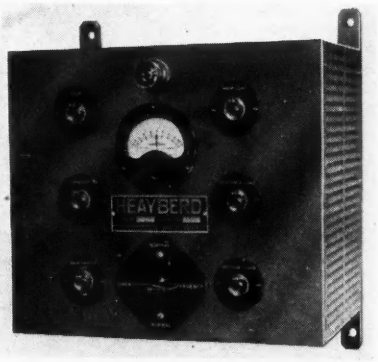
The completely sealed interior of the equipment is proof against contamination by gas.



**"Coldspot" A.R.P. refrigerator**

## Emergency A.R.P. Lighting

A comprehensive range of equipment suitable for A.R.P. installations is now available from F. C. HEAYBERD & Co., LTD., 10, Finsbury Street, London, E.C.2. Three sizes of the "A. R. P. 6" emergency lighting panel, conforming strictly to B.S./A.R.P. 6, are made—the "Junior" (12 V), the "Major" (12 V) and the "Senior" (24 V), suitable respectively for shelters holding up to 50, from 100 to 150, and from 150 to 250 persons.



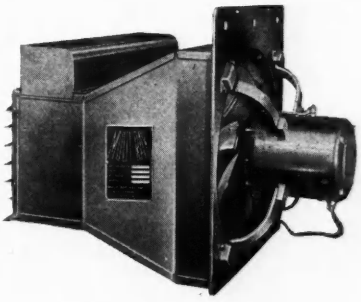

**Heayberd "A.R.P. 6" control panel**

These equipments are self-contained and comprise a battery charger, a transformer, circuit switches, &c., in a sheet-steel case. The controls on each panel are a mains switch; a charger switch; a change-over switch to connect emergency load to the battery upon supply mains failure and to reconnect load to the transformer upon resumption of supply; three emergency load switches arranged to provide full light under normal conditions, half light under emergency conditions and quarter light under prolonged emergency conditions; and a switch for a pilot lamp.

In addition, the Heayberd standard A.R.P. emergency lighting set is made in four sizes, capable of dealing with loads from 25 W, 6 V up to 150 W, 12 V. There is also available a range of battery chargers suitable for incorporating in schemes where it is intended to recharge batteries for a number of shelters at the control station. Transformers can be supplied from 12 V, 100 W type up to 25 V, 500 W.

## Industrial Unit Heaters

Unit electric fan heaters are especially suitable for factories, warehouses, garages, etc., and when thermostatically controlled are extremely economical to use. Mounted overhead they enable valuable floor space to be conserved for machinery, etc. They have low initial cost and are simple to install, requiring the minimum of maintenance.



**Multi-Ray unit heater**

The new "Multi-Ray" models made by MULTI-RAY HEATERS, LTD., Lincoln's Inn Chambers, 40/43 Chancery Lane, London, W.C.2, are neat and compact. They are constructed from heavy gauge sheet steel and incorporate adjustable louvres. The bus-bar and terminal chamber is situated at the top. The motor and fan arrangement discharges the warm air at floor level at relatively low peripheral speed, and so ensures quietness of operation. Three sizes of heater are available with ratings of 10, 15 and 20 kW.

## Electrode Soldering Equipment

A saving of 80 per cent. in power consumption as compared with electrically or gas heated soldering irons is claimed for the Stanelco electrode soldering equipment made by STANELCO PRODUCTS (Standard Telephones & Cables, Ltd.), 25, Ferndown, Northwood Hills, Middlesex. This is possible as no power is used when the tool is not actually soldering. The work too is said in many cases to be very much superior to that accomplished by other methods.

A complete range of units is available from the minor model suitable for work on electrical instruments, telephones, radio, &c., to the heavy-duty size capable of soldering lugs and terminals from 400-A up to 1,050-A and particularly useful for such jobs as air-conditioning and refrigeration installations. The apparatus is supplied complete with transformer, input and output leads, and the numerous tools available cater for all classes of work. The loading of the apparatus ranges from 80 to 2,500 W, according to size.

**Medium-duty Stanelco unit being used to solder connections on the back of a small switchboard**

## Safety Device for Oil Engines

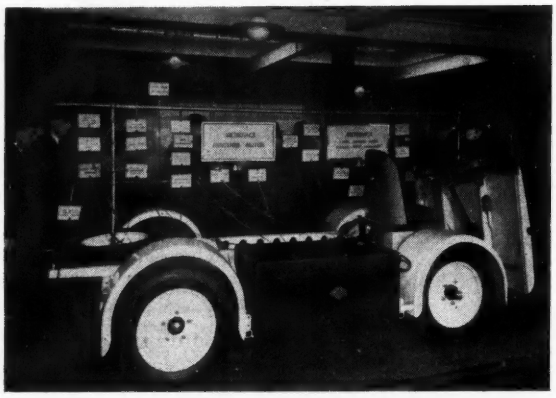
The "Monitor" pressure alarm with indicator panel combined, which is now being made by MONITOR PATENT SAFETY DEVICES, LTD., Wallsend-on-Tyne, is claimed to obviate the fitting up of separate pressure alarms and the provision of an appropriate indicator panel. The device can be quickly fitted to any standard oil engine by simply connecting the "keep open" cocks to the pump delivery leading to the engine and running a two-core cable from the engine room lighting circuit to a junction box next to a double-pole switch. A similar two-core cable connects a Klaxon to another junction box.

# COMMERCIAL and INDUSTRIAL NEWS

## Two Electric Vehicle Displays. Iron and Steel Order. Callender's Progress in 1939. Mobile Arc-welding Equipment. Guaranteed Refrigerators

### Electric Vehicle Displays

WAR conditions have brought into prominence the peculiar virtues of the electric vehicle as a convenient means of goods delivery and as a conserver of petrol supplies. The fourth National Electric Vehicle Exhibition, to be held at Quick's Showrooms, 230, Deansgate, Manchester, on February 20th and 21st will consequently take place under auspicious conditions. There will be a very representative display, and vehicles and chassis with capacities ranging from 5 cwt. to 3 tons will be shown by six manufacturers. In addition to the goods vehicles, there will also be a utility type passenger vehicle exhibited by Partridge Wilson & Co., who have previous experience in the manufacture of passenger vehicles. Batteries, chargers and other accessories will also be on view,



**A demonstration "Metrovick" electric vehicle chassis at H. & J. Quick's display at Manchester**

and visitors will be able to see not only the construction and types of vehicles and body work available, but the details which go to make up the complete vehicle. An Information Bureau will be available.

As a sort of "curtain raiser," Messrs. H. & J. Quick have during the last few days been displaying a representative selection of "Metrovick" vehicles, together with an example of a T. H. Lewis milk pram. The results obtained bode well for the larger exhibition, for we are told that during the six days, January 15th to 20th, between 30 and 40 direct inquiries were received, and that there were at least eight to ten prospective sales. The company is, in fact, astonished at the interest shown in the vehicles, and after this one week's experience, is convinced that provided sales are handled in the proper manner there is no telling how big the demand may be. This statement is all the more convincing since it comes from a firm which has sold nothing but petrol vehicles for 26 years.

### Imported Hand Lamps

The *Board of Trade Journal* states that the Import Licensing Department of the Board of Trade recently issued a slip stating that the following goods should be deleted from Group 7 (page 22) of their Notice to Importers No. 29:—Hand lamps, pocket lamps, hand torches and inspection lamps and parts (other than flash lamp bulbs of 4.5 V or less and batteries).

Notice No. 29, which dealt with the Import of Goods (Prohibition) (Consolidation) Order, 1939, was published in the *Board of Trade Journal* of January 4th. Similar goods listed in the First Schedule are not affected by the slip mentioned above.

### F.B.I. and War Risks Insurance

The Federation of British Industries has made representations to the Board of Trade regarding the premiums to be charged under Part II of the War Risks (Commodities) Insurance Act. The Federation urges that for one month, from March 3rd, the existing amounts at risk should be covered without payment of any additional premium. It is pointed out that, when the scheme was inaugurated last September, at a time when immediate claims upon the fund were contemplated, it was considered sufficient to establish a fund equal to 30s. per cent. for the three-month period September 3rd to December 2nd. Yet, by March 3rd, the date on which the next period begins, a fund will have been created equal to 35s. per cent. on the value of stocks insured. In these circumstances, the F.B.I. feels that the cash resources of industry need not be further depleted by a call for additional premiums, though it fully recognises that, in the event of severe damage, the existing fund may have to be increased.

The Federation further draws the attention of the Board of Trade to the fact that confusion has arisen from the ruling that, where a contract is for work, labour, and materials rather than for a sale of goods, the goods required for carrying out the contract are not insurable under the Act. To remove the prevailing uncertainty, it is suggested that the Act should be amended to provide that, whether or not the contract includes an element of service, commodities should be insurable up to the time of delivery to the site (under a constructional contract) or to the customer in other cases, except when ownership has passed earlier to the purchasers. This would not affect goods excluded from the Act by order of the Board of Trade, or such work as structional contracts which are now outside its scope. Were the Act amended in this sense, it would be of great assistance if Government contracting departments would adopt a uniform practice in dealing with war risk charges in their contracts or sub-contracts.

### Iron and Steel Control

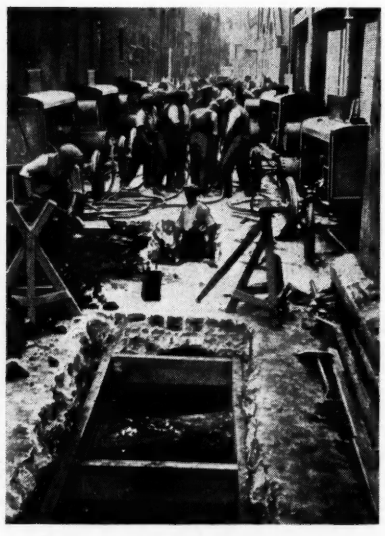
The Minister of Supply has made the Control of Iron and Stdeel (No. 6) Order, which came into force on February 1st, superseding the Control of Iron and Steel (No. 4) Order made on November 1st. In substance the previous Order is unaltered, but attention is drawn to the narrowing of the scope of the provisions for exemption from licence contained in Direction (No. 1) attached to the Order and to the price alterations. The maximum prices fixed under the Order represent an addition of 3s. per ton in the case of pig iron and £1 per ton for semi-finished and heavy steel products, with corresponding adjustments in the prices of other finished products. These additions, like the additions made as from November 1st, are for the purpose of meeting from a central fund the additional costs, including higher freight charges, which arise from importation of raw and semi-finished materials under war conditions. There are also some further adjustments in the prices of tinplates and iron castings. Copies of the Order may be obtained from H.M. Stationery Office or from any bookseller.

### Cable Making in 1939

The increasing use of electricity in aircraft and in marine work entailed the provision by Callender's Cables & Construction Co., Ltd., of a great deal of high- and low-voltage cable last year. Thus the *Dominion Monarch*, the 27,000-ton motor vessel, required 160 miles in various sizes.

An unusual contract was to run 11-kV cable from switchgear in a power station to two transformer banks at a sub-station, the route being through a tunnel under a railway embankment and a projected coal store, over a Callender-Hamilton bridge and along a gantry. For electrifying a railway clearing yard some 3,330 yd. of paper-insulated and 6,000 yd. of rubber-insulated multi-core cable, all with anti-corrosive finish, was laid direct in the ground, while 17,000 yd. of fire-proofed and braided cable was used for control panels. The whole work was completed (in conjunction with General Railway Signal Co., Ltd.) without interrupting normal working.

Approximately 7,000 yd. of various types of cable was installed at the wartime headquarters and eleven underground shelters of the Associated Portland Cement Manufacturers, Ltd. Three 270 ft. lengths of 33-kV cables have been recently installed for a Welsh municipality in a tunnel 197 yd. long by 5 ft. 4 in. in diameter under a river with 80-ft. deep shafts, space being limited by drainage plant and pipes. The cables were lowered and raised by an endless chain controlled by irreversible gear mounted above each shaft and were hauled through the tunnel by a winch. Overhead work included a 50-mile transmission line from Dublin to Dundalk, with three 19/25-



**A Callender emergency repair gang at work**

mm. copper conductors supported from wide-base lattice towers, and a combined 6.6-kV and 400-V system on single wood poles for serving 800 acres in southern England.

Impregnated pressure cable tested by the Dutch authorities at Arnhem showed no deterioration after 2,300 hr. and 104 heat cycles at 350 kV. A refrigerating chamber for high-voltage sealing-end tests has been installed at the Wood Lane laboratories. The magenta dye test for indicating the earliest stages of deterioration in cable papers has been generally adopted. Fire-resisting self-extinguishing dielectric and cold-pouring compound are notable among recent developments. Numerous orders from both home and overseas quarters have been received for hot-dip-galvanised Hamilton bridges consisting of standard parts which are bolted together on site. Export orders received also include one for seven miles of 33-kV cable for Durban, a high-voltage transmission system and overhead equipment for trolley buses at Port-of-Spain, Trinidad, and requirements for the Sudan and Ceylon.

## Prohibition of Aluminium Imports

Under the Import of Goods (Prohibition) (No. 3) Order, issued on January 22nd, imports of aluminium and alloys containing more than 50 per cent. by weight of aluminium, other than machinery parts, is prohibited except under licence from the Board of Trade.

## E.D.A. Awards

The British Electrical Development Association has awarded its salesmanship certificate to twenty-three successful candidates in the fifth final examination held on November 29th. The Garcke prize for the highest marks gained in the final examinations held in 1939 has been awarded to Miss S. M. J. Wilcox, of the Wimbledon Corporation Electricity Department. The Association has granted three additional sales engineers' diplomas and twenty-two domestic electrical salesmanship diplomas.

## Supervisors' Annual Dinner

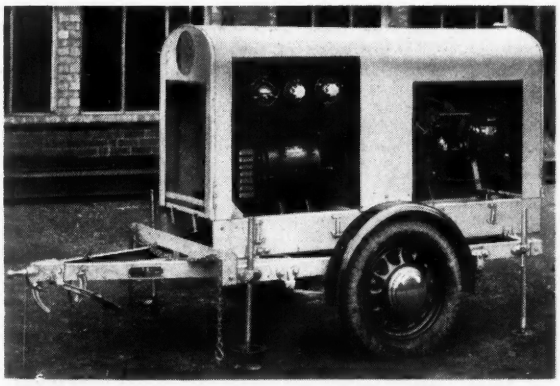
The Association of Supervising Electrical Engineers is holding its annual dinner on February 24th at the Connaught Rooms, Kingsway, W.C.2, at which the president, Mr. H. W. Swann, will preside.

## Swansea Showrooms and Offices

Swansea Corporation has approved a joint recommendation from the Electricity and Highways Committees that the central offices and showroom of the Electricity Department shall be transferred to the Central Hall, a large building in the centre of the town recently acquired by the Corporation for road widening at a cost of £18,478. There was strenuous opposition to the proposal from the Ratepayers' Group on the Council, who pointed out that by the time the Central Hall was altered and equipped the cost would run to £40,000 and perhaps more. The proposers argued that the electrical engineer desired that the whole of the offices, except those at Tir John, should be under one roof, and said that money would be saved in administration. A further point was that the lease of the Castle Street showroom expired in 1942 and they might not be able to renew the lease on the present terms.

## Mobile Arc-Welding Equipment

There is considerable scope for the use of electric arc welding in the construction and maintenance of the very wide range of plant and appliances which are employed by a river catchment board. An extremely convenient electric welding equipment for this class of service was recently manufactured by the General Electric Co., Ltd., for the River Ouse (Yorks) Catchment Board, whose headquarters are in Harrogate. The equipment consists of a DC generator driven by a Ford industrial-type petrol engine, together with suitable control and regulating gear, the whole being mounted on a chassis provided with two pneumatic tyred wheels.



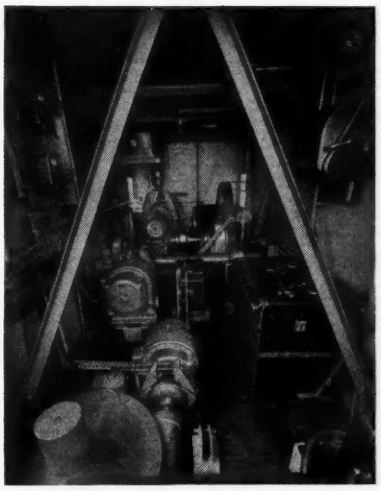
**G.E.C. transportable arc welding generator equipment**

The generator is rated, in accordance with B.S.S. No. 638, for continuous welding duty at 300 A, 25-70 V and is provided with a conveniently controlled current range of 30 to 350 A. The coarse and vernier regulators which give this control are mounted in a handy position adjacent to a combined ammeter and voltmeter above the generator. Special features introduced into the design of the magnetic circuit of the generator ensure the maximum possible voltage response to rapid changes in the resistance of the arc circuit, and result in that extra stability, ease of striking, and freedom from spatter which distinguish a satisfactory machine from an indifferent one.

The engine, a model B-PA Ford industrial unit, is direct-coupled to the generator through a Renold-Hardy flexible coupling. It develops 24 HP at its governed speed of 1,500 RPM and is therefore liberally rated for its duty. The radiator fan is arranged so that it draws air from the generator end of the set and discharges it to the outside; this avoids passing hot air from the radiator through the generator. The equipment is enclosed in a sheet-steel weatherproof housing.

## Electric Motors for a Dock Crane

Four Crompton Parkinson motors are used in a 3-ton crane supplied by Cowans, Sheldon & Co., Ltd., to the L.M.S. Railway for dock use. The crane is a general cargo unit and motors were required for the four operations of lifting, luffing, slewing and travelling. They are each "KRN" type, 460 V, series wound DC motors, the largest developing 54 HP at 750 RPM, the others developing at 1,000 RPM, 5 and 7 HP. With these motors the following operation speeds are obtained at full load: Lifting, 180 ft. per minute; slewing, 400 ft. per min.; luffing, 150 ft. per min.; and travelling, 40 ft. per min. The layout of the crane engine room is shown in the accompanying illustration.



**Crompton Parkinson motors in the engine room of an L.M.S. 3-ton cargo crane for dock use**

## Guaranteed Refrigerators

The suppliers of the following makes of domestic electric refrigerators in Great Britain have mutually agreed that as from February 1st all machines sold by them will carry a twelve months' guarantee: B.T.H., Coldair, Frigidaire, H.M.V., Kelvinator, Marco and Prestcold.

## Approved Street Lighting Lanterns

The B.S.I. Licence No. 303, granted to the General Electric Co., Ltd., to manufacture 60-W units for 20-ft. nominal mounting heights, has been twice extended, and it now covers not only a similar unit for use with 40-W lamps at 15-ft. nominal height, but also an entirely different design for use with 15-W lamps at 10-ft. nominal height. Thus a range of G.E.C. street-lighting units covering all the mounting heights normally employed has received official approval and is now available. The design of the new 15-W unit embodies a patented type of optical system, employing a flashed opal cylinder with a surrounding metal grid to provide the correct light distribution and intensity at the nominal mounting height of 10 ft. Like its predecessors, the unit is designed for easy attachment to existing lanterns without removing them from their supports, and it can be carried either by the lantern body or by the lamp-holder. When carried by the lantern itself, no rewiring is necessary, the new lampholder being connected by a short length of flexible cord to an adaptor which fits into the existing holder. The conversion can be carried out in a few minutes by unskilled labour. The bottoms of the units are removable, allowing easy maintenance. For cases where it is impossible to utilise the existing lanterns the G.E.C. has designed a special unit, incorporating the same optical system, but modified so as to be weatherproof and arranged with a top tapping for attachment to a bracket.

## Certification of Meters

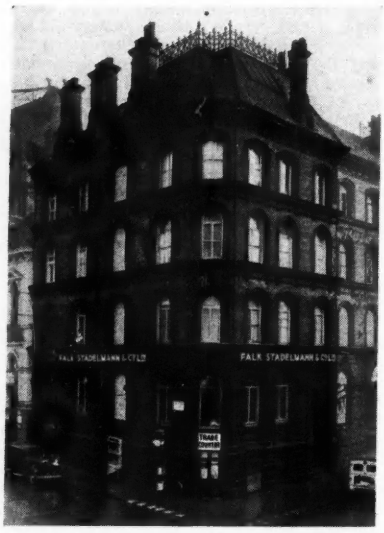
In last week's article on this subject by Mr. S. H. Richards, under the sub-heading of "Trend in Accuracy" (page 93), it was inadvertently stated that "tests are made by examiners at one-tenth, intermediate and either full or over load"; this is incorrect, since one-twentieth is the prescribed lower loading.

## Repairing German-made Motors

The repairing of electric motors made in Germany is presenting a problem to many users. The Midland Electric Installation Co., Ltd., Cyprus Works, Upper Villier Street, Wolverhampton, tells us that it is now specialising in the repair and redesigning of this class of equipment.

## Trade Announcements

Midland Vehicles, Ltd., has appointed the following new distributors: United Service Garages (Portsmouth), Ltd., 126, High Street, Portsmouth; Haslemere Motor Co., Ltd., Morris House, Guildford; F. W. Keighley, Ltd., 41, Blackwellgate, Darlington.



**The premises at 50, Wellington Street, Leeds, of Falk, Stadelmann & Co., Ltd., to which this branch moved at the beginning of January**

## Purchase of Rhodesian Copper

A *Reuter* message states that the British authorities are negotiating for the purchase of an extra 50,000 tons of copper from Rhodesian producers. The producers are seeking a slightly higher price than that accorded them under the agreement announced on November 11th on the grounds of labour shortage occasioned by the war, together with extraction plant expenses rendered necessary by the accelerated production desired.

## Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

| CHEMICALS, ETC. | Price January 31st. | Fortnight's inc. or dec. |
|---|---|---|
| *a* Acid oxalic ... ... ... ... per cwt. | Suspended | — |
| *a* Ammoniac, Sal ... ... ... per ton | | — |
| *a* Ammonia, Muriate (large crystal)... ,, | | — |
| *a* Borax... ... ... ... ... ,, | | — |
| *a* Copper, Sulphate ... ... ... ,, | | — |
| *a* Potash Chlorate ... ... ... per lb. | | — |
| *a* ,, Perchlorate ... ... ... ,, | | — |
| *a* Shellac ... ... ... ... per cwt. | | — |
| *a* Sulphur, Commercial ... ... per ton | | — |
| *a* ,, Roll ... ... ... ,, | | — |
| *a* Soda, Chlorate ... ... ... per lb. | | — |
| *a* ,, Crystals ... ... ... per ton | | — |
| *a* Sodium. Bichromate, casks ... per lb. | | — |
| METALS, ETC. | | |
| *b* Aluminium, Ingots ... ... ... per ton | £110 | — |
| *b* ,, Wire ..... ... ... per lb. | 1/3 to 1/9 | — |
| *b* ,, Sheet and Foil ... ... ,, | 1/6 to 2/9 | — |
| *p* Babbits Metal and Anti-friction Metals— | | |
| Grade I ... ... ... per ton net | £197 | — |
| Grade II ... ... ... ... ,, | £137 | — |
| Grade III ... ... ... ... ,, | £73 | — |
| *c* Brass (rolled metal 2" to 12" basis)... per lb. | 9¾d. | — |
| *c* ,, Tubes (solid drawn) ... ... ,, | 1/1¼ to 1/1½ | — |
| *c* ,, Wire, basis ... ... ... ,, | 10¾d. | — |
| *c* Copper Tubes (solid drawn) ... ,, | 1/2½ | — |
| *g* ,, Bars (best selected) ... per ton | £95 | — |
| *g* ,, Sheet... ... ... ... ,, | | |
| *g* ,, Rod ... ... ... ... ,, | | |
| *d* ,, (Electrolytic) Bars ... ... ,, | £62 | — |
| *d* ,, ,, Wire Rods ... ,, | £65.10s. | — |
| *d* ,, ,, H.C. Wire ... per lb. | 9½d. | — |
| *f* Ebonite Rod ¼" dia. & up ... ... ,, | 1/10to2/3 + 10% | — |
| *f* ,, Sheet ⅛" thick & up ... ,, | 1/4 to 1/8 adv. | — |
| *n* German Silver Wire, Nos. 1 to 12... ,, | 2/5 | — |
| *h* Gutta-percha, fine ... ... ... ,, | Nom. | — |
| *h* India-rubber, Parafine ... ... ,, | 1/1 | — |
| *g* Lead, English Pig ... ... ... ,, | £26.10s. | — |
| *g* Mercury ... ... ... ... per bot. | $200 | — |
| *e* Mica (in original cases) small ... per lb. | 1/3 to 3/– | — |
| *e* ,, ,, ,, medium ... ,, | 9/– to 18/– | — |
| *e* ,, ,, ,, large ... ,, | 20/– to 27/6 | — |
| *p* Phosphor Bronze, plain castings ... ,, | 1/2½ | — |
| *p* ,, ,, drawn bars & rods ,, | 1/3½ | — |
| *p* ,, ,, rolled strip & sheet ,, | 1/1 | ¼d. dec. |
| *p* ,, ,, wire ... ... ,, | 1/3 | ¼d. dec. |
| *o* Platinum ... ... ... ... per oz. | £10 | — |
| *d* Silicium Bronze Wire ... ... per lb. | 8¾d. | — |
| *g* Spelter ... ... ... ... per ton | £25.15s. | — |
| *g* Tin, Block (English) ... ... ,, | £238.10s. | £4 dec. |
| *n* ,, Wire, Nos. 1 to 16 ... ... per lb. | 4/9 | — |

Quotations supplied by:—

*a* G. Boor & Co.
*b* The British Aluminium Co., Ltd.
*c* Thos. Bolton & Sons, Ltd.
*d* Frederick Smith & Co.
*e* F. Wiggins & Sons.
*f* India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
*g* Henry Gardner & Co., Ltd.
*h* Edward Till & Co.
*n* P. Ormiston & Sons.
*o* Johnson Matthey & Co.
*p* C. Clifford & Sons, Ltd.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in this section under the same heading.

## A.R.P. Lighting

To-day (Friday) Sir John Anderson, Home Secretary, is opening an exhibition of A.R.P. lighting for shops, industrial and domestic premises, shelter lighting, heating, ventilation, &c., at the Building Centre, 158, New Bond Street, W. Lord Lytton, President of the British Electrical Development Association will preside at the inauguration of the display which will be continued for three weeks or perhaps longer.

## Bowl Fire Fatality

At an inquest at Rotherham on Lucy Ann Mitchell (41), of Greasborough, her husband, a miner, said that he left an electric bowl fire in the kitchen and when he returned home he found his wife lying in the empty bath with the electric fire on her lap. A police officer stated that the woman was fully clothed in a sitting position, and he thought she had collapsed into the bath. His opinion was that she got a shock when she was carrying the fire in one hand and took hold of a tap with the other. An electrical engineer said that a wrong adaptor had been used. A verdict of "Accidental death" was returned.

## Air-break Switchgear

Six standard specifications issued between 1930 and 1934 (Nos. 109-110-124-126-127-130) relating to air-break switchgear, including knife, isolating, totally enclosed and flame-proof types, have been revised. Since many of the clauses were common to all, their use will be facilitated by combination in two new B.S.S., 861 for switches and 862 for circuit-breakers, obtainable from the British Standards Institution, Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. each, post free.

## Calendars and Diaries

Electricity House, Ltd., has sent us a pocket diary with a navy-blue limp-leather binding. This contains a good deal of useful information relating to the company, the Yorkshire Electric Power Co., and associated companies.

We have received an attractive calendar from Ercole Marelli & Co., S.A., of Milan. This has weekly sheets bearing pictures of beauty spots and places of interest in Italy.

"Pals," a well-executed drawing of a young man and his dog, makes an effective picture for the calendar received from R.N. Electrical Repairs, Ltd.

The calendar of British Timken, Ltd., has large monthly sheets which also show the preceding and following months. Each sheet bears an illustration of some of the company's products.

## New Catalogues and Lists

**E. G. Acheson, Ltd.,** Thames House, Millbank, London, S.W.1.—A folder pointing out the qualities of "Dag" colloidal graphite for protecting plant from breakdown.

**Rawlplug Co., Ltd.,** Cromwell Road, London, S.W.7.—A folder giving particulars of the new "Slip" penetrating mineral compound oil.

**General Electric Co., Ltd.,** Magnet House, Kingsway, London, W.C.2.—A leaflet describing the uses to which "Philplug" asbestos jointing compounds made by Philplug Products, Ltd., for whom the G.E.C. acts as distributor, can be put for A.R.P.

**Switchgear & Equipment, Ltd.,** Southam Road, Banbury.—A leaflet drawing attention to the company's wide range of switchgear, which now embraces almost every type used by distribution engineers, from low-voltage cable units and fuses to high-voltage oil-immersed switchgear.

**Partridge, Wilson & Co., Ltd.,** Davenset Works, Evington Valley Road, Leicester.—Particulars of the new "Davenset-Drimet" model "A" battery charger, a three-circuit universal unit employing metal rectification, intended for the small trader.

**R. Cadisch & Sons,** Red Lion Square, London, W.C.1.—The domestic appliance section of the company's electrical catalogue for 1939-40. It contains 54 pages and is fully illustrated. All prices include recent increases.

**Falk, Stadelmann & Co., Ltd.,** 83-93, Farringdon Road, London, E.C.1.—A folder showing a revised range of "Efesca" bells and accessories. Also a leaflet describing the new "Efesca" bell transformer.

**Contactum, Ltd.,** Victoria Works, Edgware Road, Cricklewood, London, N.W.2.—A catalogue of "Contactum" electrical accessories.

**George Cohen, Sons & Co., Ltd.,** Wood Lane, London, W.12.—Stock lists of second-hand pumps, fans and blowers.

**Holophane, Ltd.,** Elverton Street, Vincent Square, London, S.W.1.—An illustrated folder describing the company's type "302" low-intensity street-lighting units.

# Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

COOLEX switchgear (present suppliers).

# ELECTRICITY SUPPLY

## Chichester Engineer's Preference for Hire-purchase. Estimated Profits at Hull and Manchester. Joint Manager Suggestion Rejected at Morecambe

**Barking.**—LIGHTING OF TRENCHES.—The Emergency Committee reports that the London Civil Defence Region has raised no objection to the lighting of trenches by electricity at a reasonable expense. The cost is estimated at £3,391.

**Chester.**—RURAL EXTENSIONS.—The city electrical engineer reported to a recent meeting of the Finance Committee that it would cost approximately £1,350 to provide supplies to two potential consumers in the rural area. It was decided that application should be made for loan sanction.

**Chichester.**—HIRE AND HIRE-PURCHASE.—In December a new measure was introduced—not due to the war—to limit the hiring scheme to existing stocks of cookers, water heaters and wash boilers. In order not to restrict the use of these appliances by consumers, extended hire-purchase terms were introduced, up to eight years for water heaters and up to seven years for cookers and wash boilers. The quarterly repayments, including wiring, on this basis are on a par with the previous hire terms for new apparatus. The effect will be to minimise the present heavy cost of renovations as the onus will be upon the consumer to keep the apparatus in a good condition. During the entire period of hire-purchase the cost of reasonable electrical maintenance will be borne by the Department. Mr. H. E. Taunt, commercial manager, has found that the continued simple hire of new appliances, which must necessarily be standardised, has a tendency to curtail progress in development, such as simmering plates, thermostatically controlled ovens, streamlining, special colour finishes, &c. Hire-purchase removes this restriction and allows consumers to take advantage of such improvements.

REVISION OF TARIFFS.—On the outbreak of war it was difficult to anticipate the effect on financial results having regard to the many unforeseen factors. Although Chichester is a reception area it was not certain that there would be any increase in the sale of electricity, due to the restrictions imposed. In view of the higher costs it was decided, therefore, to make a small immediate increase which might obviate the necessity at a later date of recovering a possible deficit by the introduction of a large increase which could quite possibly defeat its object by decreasing sales. Excluding bulk supply to Bognor, the amount of electricity sold in the area, comprising some 72 squares miles, during the December, 1939, quarter, was more than in the corresponding quarter of 1938, the increase being due, as was anticipated, to the full winter occupation of the seaside districts, Selsey, East Wittering and West Wittering. Hitherto, these areas were mainly occupied for summer residence and represented a profitable non-peak load to the undertaking, whereas these now constitute a peak load and although more electricity has been sold the margin of profit appears to be less.

**Colne Valley.**—INCREASED CHARGES.—An increase in charges to take effect from February 20th is announced by the Colne Valley Electric Supply Co. The lighting flat rate is being raised by ½d. to 6½d. per kWh, the water heating rate by ½d. to ¾d., and the two-part tariff "unit" rate by 0.15d. to ¾d.

**Cornwall.**—SUPPORT FOR OPPOSITION TO BILL.—Recently the Penzance Town Council circularised local authorities in the county asking them to support it in opposing a Bill to be promoted by the Cornwall Electric Power Co., and subsequently the Truro City Council, Falmouth Town Council, and Camborne-Redruth U.D.C. have decided to do so. The matter was raised at the last meeting of the County Council, when the chairman said he understood that what the ratepayers wanted to be guarded against was an increase in electricity charges. It was decided that the County Council should support the local authorities in their action.

**Fleetwood.**—INCREASE TO INCLUDE HIRE CHARGES.—Recently members of the Council questioned whether the Electricity Department was entitled to apply the price increase of 7½ per cent. to hire charges. Last week the Finance and General Purposes Committee decided that the increase should include the rental of appliances.

**Hull.**—REVENUE ESTIMATES.—In a financial statement submitted at last week's meeting of the City Council Mr. D. Bellamy, general manager, said it would be noted with satisfaction that, despite the war conditions involving a fall in the probable revenue for the current year of more than £150,000 and increased costs, the confident policy adopted in October of maintaining tariffs at pre-war levels and reconstituting the organisation had been justified. The probable position briefly, was a revenue surplus of £44,350; this would be sufficient to meet special capital appropriations without any call upon the reserve fund, which should be increased by the amount of a refund from the Central Electricity Board. The policy of providing hired apparatus, ordinary meters, special expenditure on air raid precautions, &c., from revenue surplus would thus be maintained. For the following complete financial year, *i.e.*, to March 31st, 1941, the position obviously was more problematic. The estimated fall in income from the pre-war trend for that period exceeded £200,000. Nevertheless, it was estimated that there would be a surplus on revenue account of £2,461. This would be insufficient to meet the estimated requirements for appropriations of a special and capital nature, and to avoid any call upon the reserve fund for this purpose an increase in price of 5 per cent. on all supplies was proposed, commencing with the June quarter. Mr. Bellamy added that the cash discount of 5 per cent. allowed on all basic standard tariffs would remain.

**Kettering.**—TARIFF REVISION.—The Town Council has been informed by the Electricity Committee that the electricity tariff will have to be reconsidered. A small loss on the undertaking is certain this year, and the charges will be raised after the present quarter.

**London.**—POPLAR.—The Poplar Emergency Committee has approved a scheme for the provision of 1,523 illuminated location and direction signs in connection with A.R.P. at a cost of £4,940.

ISLINGTON.—An advance of 20 per cent. in the price of electricity supplied through ordinary meters has been approved by the Council, and an increase of ½d. to 4d. per kWh (5d. under the rental wiring scheme) is being made in the case of electricity supplied through prepayment meters.

ST. MARYLEBONE.—From the next meter readings the lighting flat rate is being raised from 4d. to 6d. per kWh and the flat rate for heating, cooking and miscellaneous use from ¾d. to 1¼d. Under the two-part tariff for lighting, heating, &c., both the fixed and running charges will be increased, the latter from ⅝d. to $1\frac{5}{8}$d., and various other tariffs will be advanced correspondingly. The necessity for these increases, on the basis of 50 per cent., was explained at a recent meeting of the Council (ELEC. REV., January 12th).

**Manchester.**—ESTIMATED PROFIT.—It was stated at a meeting of the Electricity Committee last week that, assuming present prices for electricity remained unaltered, income on revenue account during the next financial year would in all probability be reduced, but this would be offset by smaller expenditure on distribution and by the use of reserves to cover certain expenses of a capital nature normally financed out of revenue. Rates and coal prices would be higher, but it was estimated that the Department would show a small profit at the end of the year. It was estimated that the sales of electricity in 1940-41 would show an increase over the present year.

**Morecambe.**—JOINT MANAGER "IMPRACTICABLE."—When the resignation of Mr. P. Clegg, borough electrical engineer, on his appointment at Macclesfield, was reported to the Town Council recently it was decided that the Gas and Electricity Committees should consider the possibility of the gas and electricity services being united under one manager. A joint electricity and gas committee has, however, reported that it would be impracticable to combine the two undertakings under one engineer, and it has been decided to appoint a new electrical engineer to succeed Mr. Clegg.

**Northern Ireland.**—BELFAST RATE CONTRIBUTION.—Subject to the approval of the Council the Belfast Electricity Committee proposes to contribute £11,000 to the relief of the 1940-41 rates. This follows representations made by the Finance Committee.

**Plymouth.**—COAL HANDLING PLANT.—Sanction of the Electricity Commissioners to the borrowing of £3,810 for the extension of the coal handling plant at the Prince Rock generating station was reported to the Electricity and Street Lighting Committee at a meeting on January 22nd.

**Rawtenstall.**—MINIMUM CHARGES WAIVED.—In view of the fact that rationing had been in operation for a time and afterwards economy was urged upon consumers, the Electricity Committee has decided to waive minimum charges for the past twelve months.

## "Haw-Haw" Again

NOT content with inflicting heavy losses on paper—or, rather, by the ether—on the British Navy and Air Force, the ineffable "Lord Haw-Haw" has wish-fulfilled the blocking of the Manchester Ship Canal as the result of a transformer explosion. In view of its source, the inaccuracy of the statement is hardly open to question. Actually, the Canal was not in any way damaged by the explosion, which occurred at the 33-kV sub-station of the Stretford Electricity Board at Irlam on January 26th, and traffic was quite normal. Inconvenience there certainly was, but this was felt by the consumers of electricity and was due to the interruption in their supplies. We are informed that the fire, which was due to electrical causes (sabotage is not suspected), was got under control by the local fire brigade within half an hour.

**Stoke-on-Trent.**—ELECTRIC LIGHTING IN COUNCIL HOUSES.—The Housing Committee is communicating with the Ministry of Health with regard to a proposal to install electric lighting in place of gas in Council houses at Meir.

SUPPLY TO COLLIERY.—Having arranged terms for providing an electricity supply to the Wolstanton Colliery the Electricity Committee is to lay the necessary mains at an estimated cost of £2,750.

**West Hartlepool.**—BULK SUPPLY CHARGES.—The Town Council is inviting representatives of electricity undertakings to attend a conference to discuss the increase in the price to local authorities for the supply of electricity in bulk by the North-Eastern Electric Supply Co., Ltd. On the same subject it was recently reported to the Tynemouth Town Council that a letter had been received from the North-East Centre of the I.M.E.A. setting out the resolutions which had been passed by the Council of the Association. The Association stated that it was prepared to grant the necessary technical and financial advice in the preparation of a case in appealing to the Electricity Commissioners against the new terms.

# COMMUNICATIONS

**Great Britain.**—RADIO RELAY AT JARROW.—The Jarrow Town Council has consented to Northern Rediffusion, Ltd., placing wires and fittings on Council property and erecting wires over streets in connection with the establishment of a radio relay service.

TELEPHONE SERVICE INTERRUPTED.—Flooding of a cable recently caused dislocation of the telephone service involving more than 500 subscribers on the Primrose (London) exchange. Drying the cable took several days and was completed on Wednesday last week.

**Italy.**—DEVELOPMENT OF TELEVISION.—At the instigation of the Ministries of Communications and Education a committee has been set up to study questions relating to the development of television in Italy, reports *Reuter's Trade Service* from Milan. The committee recently met for the first time when the Minister of Education outlined the nature of the work, paying attention to both the technical and artistic problems raised by this new application of radio. After an interesting discussion, in which all the members of the committee joined, a programme was formulated and approved by the presiding Minister.

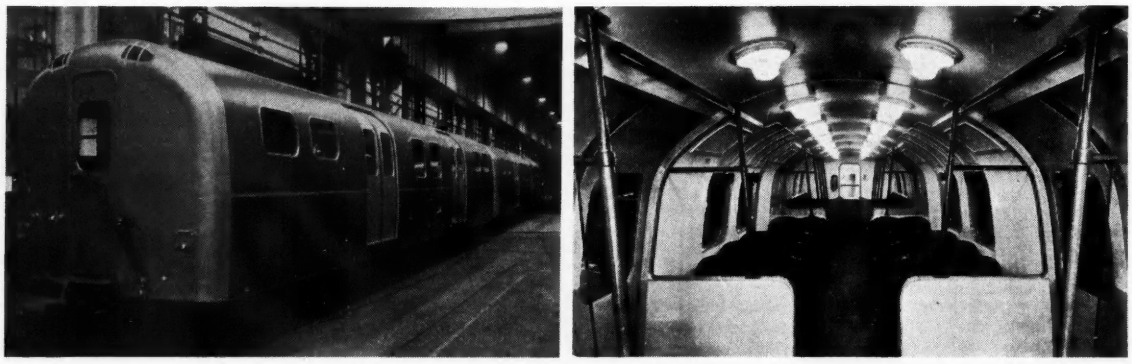
# TRACTION

**L.M.S. Railway.**—TRAINS COLLIDE.—Two passenger trains on the Liverpool-Southport electric railway came into collision last week, but of the 800 passengers only two required hospital treatment, one being detained in hospital with leg injuries. The accident occurred when the 8.15 a.m. train from Southport, one of the new steel type recently introduced on the line, had drawn alongside the platform at Seaforth station and was run into by a second train travelling in the same direction. The trains were not derailed.

**L.N.E. Railway.**—ELECTRIFICATION TO BE COMPLETED.—It is announced that despite the war the electrification of the L.N.E.R. suburban lines from Liverpool Street and Fenchurch Street stations to Shenfield is to be completed.

**Manchester.**—TRANSPORT ESTIMATES.—In the annual estimates of the Transport Committee it is revealed that a loss of £98,600 may be anticipated on the tramways in the coming year. Based on the increased fares already approved by the City Council, the figures show an estimated profit of £140,000 on motor-buses and £19,300 on trolley-buses. The mileage on which the tramway estimates are based is 7,500,000, a decrease of 600,000 due to conversion of tramway routes to motor-buses and trolley-buses. The present average revenue per car mile on the tramways is 1s. 4d.. Bus mileage is estimated at 25,000,000, a decrease of 2,500,000 due to fuel rationing. Only trolley-buses are expected to show an increased mileage. The estimate is 2,500,000, an increase of 200,000. Revenue on the trolley-buses is based on present earnings of 18.50d. per mile.

**Southern Railway.**—MODERNISATION OF CITY LINE.—In spite of the heavy calls upon the Southern Railway, due to the war, the company is pressing forward with the modernisation of the Waterloo and City line, and the culmination of many months of intensive work will be reached shortly. New rolling stock of the most modern design has been constructed, the decoration scheme being bright and cheerful. Passengers will find the five-minute journey much quieter, as the rails have been welded to reduce noise. A low-level connection with the Central line of the London Passenger Transport Board's system is being provided, and also an automatic lighting system. Although it is not possible to give the exact date of the change-over, it is expected this will take place early this summer, when it will be necessary to close the line for a few days. The City station will be renamed "Bank."



**One of the new trains for the Waterloo and City Railway, with a view of the interior**

# Heavy Sunday Demand

IN a number of areas there were interruptions of the electricity supply on Sunday, January 21st, when the cold weather brought about a large increase in the heating load and overloading occurred. At Blackpool, where there was a record output, the supply in some districts failed for a short time in the middle of the day.

In the Littleover district of the Derby undertaking's supply area there was no electricity from 9.30 a.m. until 2.30 p.m., and at Alvaston the failure lasted several hours. According to the *Derby Evening Telegraph*, Mr. F. H. Pooles, the borough electrical engineer, stated that consumers had switched on all their available heating apparatus, and this coincided with the cooking load, which was heavier on Sunday than on other days. The demands of the districts concerned rose to levels far in excess of anything previously experienced. This caused the protective gear to operate, and in some instances there was damage to apparatus which took a considerable time to repair. Mr. Pooles pointed out that consumers could assist in this direction by notifying the Electricity Department whenever they acquired additional apparatus, in order that provision might be made by the Electricity Department to cover all eventualities.

At Preston the demand was the largest for eleven years, and there was interference with the electricity supply in various parts of the town. In some districts of Cheltenham there was a breakdown of from two to three hours' duration, which Mr. W. J. Bache, the borough electrical engineer, said was due to overloading. He added that he had heard of one house where nine radiators were in use on that particular morning.

At Darlington it is reported that the output was 53 per cent. higher than on the same day last year.

The demand at Loughborough exceeded that in any previous day, including weekdays, and a temporary failure occurred in one district due to a transformer switch tripping out. In the Doncaster supply area Wheatley Hills and some parts of Bennetthorpe were without electricity for about an hour. In Warrington and district there was a partial failure throughout the day, the supply improving in some areas towards night. Other places in Lancashire and North Cheshire affected included parts of Manchester, Altrincham, Timperley, Sale, Hale, Broadheath, Stockport, and Bramhall. At Wigston, in the area of the Leicestershire and Warwickshire Electric Power Co., there was a breakdown lasting up to about one o'clock in the afternoon.

In the south, Brighton had to cope with a record demand on the following day, when 1,521,000 kWh was generated, compared with the previous highest of 1,462,000 kWh in December, 1938.

# NEW PATENTS

## Electrical Specifications Recently Published

*Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.*

**1937**

15166. "Sound recording." F. A. Kendrick and E. F. Dackers. July 1st, 1938. (516512.)

**1938**

9578. "Electrical communication systems." Telephone Manufacturing Co., Ltd., and L. H. Paddle. March 29th, 1938. (516615.)

10017. "Arrangement for commutating current in rectifiers of the space-discharge type." Allmänna Svenska Elektriska Aktiebolaget. April 2nd, 1937. (516517.)

11368. "Telephone systems." Telephone Manufacturing Co., Ltd., J. G. Flint and C. F. Ellis. April 13th, 1938. (516519.)

11948. "Antenna systems." W. W. Triggs (Pan American Airways Corporation). April 21st, 1938. (516563.)

12771. "Electrical filters." Marconi's Wireless Telegraph Co., Ltd., N. M. Rust, and E. F. Goodenough. April 28th, 1938. (Cognate application, 30614/39.) (Addition to 474387.) (516422.)

15641. "Radio navigational systems for aircraft or watercraft." S. Smith and Sons (Motor Accessories), and F. W. Meredith. May 25th, 1938. (516567.)

15684. "Electro-magnetic relays." H. Jackson. May 26th, 1938. (516429.)

16235. "Indirect - lighting fittings." G. D. Skinner, and Benjamin Electric, Ltd. May 31st, 1938. (Cognate application 661/39.) (516522.)

16552. "Electric tumbler switches." E. Frank. June 2nd, 1938. (516619.)

16608. "Activation of cathodes in electron-emitting devices." F. J. G. Van Den Bosch. June 2nd, 1938. (516571.)

16609. "Cathode-ray tubes." F. J. G. Van Den Bosch. June 2nd, 1938. (516620.)

16611. "Electron-multipliers." F. J. G. Van Den Bosch. June 2nd, 1938. (516621.)

18386/18387. "Electric circuit-breaking devices of the gas-blast type." A. Reyrolle and Co., Ltd., F. Coates, B. H. Leeson, and A. Allan. June 21st, 1938. (516529/516530.)

18389. "Electric circuit-breakers of the air-blast or gas-blast type." A. Reyrolle and Co., Ltd., and A. Allan. June 21st, 1938. (516531.)

18390. "Electric circuit-breaking devices of the gas-blast type." A. Reyrolle and Co., Ltd., and A. Allan. June 21st, 1938. (516532.)

18594. "Electrical plugs or sockets." C. R. Cook. June 22nd, 1938. (516435.)

18984. "Electric heating elements." General Electric Co., Ltd., and J. L. Rycroft, June 27th, 1938. (516441.)

19028. "Apparatus for the production of rapidly moving ions." Siemens and Halske Akt.-Ges. August 20th, 1937. (516446.)

19029. "Production of coatings of highly polymerised artificial materials on wires, threads, and the like." Siemens-Schuckertwerke Akt.-Ges. June 25th, 1937. (516447.)

19092. "Recording device." W. L. Jones (Favag Fabrik Elektrischer Apparate Akt.-Ges) June 28th, 1938 (Convention not granted.) (516540.)

19093. "Magnetic electron lenses." H. Miller, and J. E. I. Cairns. June 28th, 1938. (516478.)

19106. "Contact breakers for electrical ignition apparatus of internal-combustion engines." J. Lucas, Ltd., and A. Allen-Massey. June 28th, 1938. (516479.)

19124. "Means for protecting electrical apparatus against surges and excessive voltages." General Electric Co., Ltd., and L. W. Barsdorf. June 28th, 1938. (516482.)

19144. "Electron-discharge devices and grid structures therefor." Standard Telephones and Cables, Ltd., and F. D. Goodchild. June 28th, 1938. (516543.)

19159. "Electric ratio-meters." Sangamo Weston, Ltd., G. F. Tagg, and G. Gilliver. June 28th, 1938. (516452.)

19171. "Methods of and apparatus for producing kinematograph and television images." L. H. Huitt. June 28th, 1938. (516486.)

19179. "Electric interlocking systems for railway signalling purposes." Vereinigte Eisenbahn-Signalwerke Ges. July 1st, 1937. (516576.)

19228. "Electric oscillation generating circuits." Telefunken Ges. für Drahtlose Telegraphie. June 29th, 1937. (516581.)

19260. "Electrodes for secondary batteries." Young Accumulator Co., Ltd., H. De Martis and S. J. Clark. June 29th, 1938. (516453.)

19283. "Electron-discharge devices." Marconi's Wireless Telegraph Co., Ltd. June 29th, 1937. (Cognate application 19284/38.) (516551.)

19336. "Sparking-plugs." E. R. Plugs, Ltd., and D. A. Pacy. June 29th, 1938. (516492.)

19440. "Volume-control devices for wide-band amplifiers." Marconi's Wireless Telegraph Co., Ltd. June 30th, 1937. (516596.)

19441. "Radio receivers." Marconi's Wireless Telegraph Co., Ltd. June 30th, 1937. (516495.)

19444. "Cathode-ray tubes." British Thomson-Houston Co., Ltd. June 30th, 1937. (516455.)

19445. "Electric motor protective systems, and apparatus therefor." British Thomson-Houston Co., Ltd. July 1st, 1937. (516597.)

19453. "Shell-type transformers." E. Wirz. July 5th, 1937. (516456.)

19466. "High-frequency measuring resistances, and methods of measuring and employing such resistances." Siemens & Halske Akt.-Ges. July 15th, 1937. (516602.)

19484. "Electro magnetically operated switch mechanism." E. Home and Co. (1931), Ltd., and R. H. Fawcett. July 1st, 1938. (516459.)

19569. "Electrolytically refining copper and the alloys thereof, and electrolytically treating metals plated with copper and the alloys thereof." Siemens & Halske Akt.-Ges. October 1st, 1937. (516610.)

19571. "Wave amplifying systems." Standard Telephones and Cables, Ltd., and A. H. Roche. July 1st, 1938. (516628.)

19572. "Circuit arrangements for the remote-control of motors in telegraph systems." Standard Telephones & Cables, Ltd. (L. B. Haigh.) July 1st, 1938. (516629.)

19573. "Carrier-wave transmission systems." Standard Telephones & Cables, Ltd., and C. W. Earp. July 1st, 1938. (516630.)

19575. "Indicators for radio-television receivers." Kolster-Brandes, Ltd., and C. E. Lock. July 1st, 1938. (516631.)

19581. "Electric floodlights and the like." General Electric Co., Ltd., and H. J. A. Turner. July 1st, 1938. (516632.)

19587. "Electric control apparatus for tuning radio receivers." British Thomson-Houston Co., Ltd. July 1st, 1937. (516633.)

19646. "Cathode-rays tubes." Baird Television, Ltd., and L. R. Merdler. July 2nd, 1938. (516637.)

19662. "Pivotal joints for electric fittings." H. C. Cooper. July 2nd, 1938. (516640.)

19667. "Equi-signal radio beacons." Marconi's Wireless Telegraph Co., Ltd., B. J. Witt, and J. G. Robb. July 2nd, 1938. (516642.)

19668. "Radio and like transmitters." Marconi's Wireless Telegraph Co., Ltd., and H. J. H. Wassell. July 2nd, 1938. (516643.)

19737. "Automatic frequency control circuits for superheterodyne." Marconi's Wireless Telegraph Co., Ltd. July 3rd, 1937. (516647.)

19738. "Remote-control systems." Marconi's Wireless Telegraph Co., Ltd. July 3rd, 1937. (516648.)

19804. "Automatic lubricator for the current collector of an electric vehicle." G. Tovarosi Fischer. May 31st, 1938. (516654.)

21164. "Electric wave transmission systems." Rediffusion, Ltd., and A. Cross. July 16th, 1938. (516500.)

21393. "Radio receivers." N. H. B. Brown. July 19th, 1938. (516504.)

**1939**

4491. "Electric steam iron." A. Tricomi and E. B. Tricomi. February 10th, 1939. (516559.)

24069. "Synchronising and speed-control devices." Rolls-Royce, Ltd., Newton Bros. (Derby), Ltd., F. Newton, and Rotol Airscrews, Ltd. May 11th, 1938. (Divided out of 515934.) (516613.)

31096. "Electron multipliers." F. J. G. Van Den Bosch. June 2nd, 1938. (Divided out of 515621.) (516664.)

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# TRADE MARK APPLICATIONS

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 24th :—

Motorola. No. 575602. Class 8 (III). Wireless telephonic receiving sets specially adapted for use on motor vehicles and parts thereof.—Galvin Manufacturing Corporation, Chicago, U.S.A. (British representatives: F. J. Cleveland & Co., 29, Southampton Buildings, Chancery Lane, London, W.C.2.).

Lectrimo. No. 608591. Class 7 (IV). Electric lawn mowers, power units for converting hand lawn mowers to electric lawn mowers, edge trimmers and edge cutters, all electrically driven, &c.—Norman E. W. Gapp, Charles W. Kingston and James W. Urquhart, trading as Power Appliances, 68, London Road, North Cheam, Surrey.

Prefect. No. 609946. Class 8 (IV). Electrical instruments for shaving and for removing hair from the face and body, and parts of such machines.—Grimwood and De Geus, Ltd., Moorgate Station Chambers, Moorfields, London, E.C.2.

Fortex, manufactured by Aspinall's Battery Service, Huddersfield (lettering and design). No. 608152. Class 9 (IV). Electric batteries. Reginald Aspinall and Alfred Boothroyd, trading as Aspinall's Battery Service, Back Spring Street, Huddersfield.

Tandulator. No. 609613. Class 9 (IV). Electrically operated heat balancing device or thermal storage device for use in connection with domestic hot water installations and steam boiler plant.—Richard Crittall & Co., Ltd., Bush House, Aldwych, W.C.2.

Samsull. No. 609464. Class 11 (IV). Electric lamp bulbs, torches, bicycle lamps and pocket lamps.—Samuel D. Sullam, 72, Newman Street, London, W.1.

# FINANCIAL SECTION

**New Companies. Returns of Capital. Debenture Charges. Bankruptcies and Liquidations. Reports of Electrical Companies. Dividend Announcements. Stocks and Shares**

## New Companies Registered

**Rushlite Batteries, Ltd.**—Private company. Registered January 23rd. Capital, £9,500. Objects: To carry on the business of manufacturers and repairers of, agents for and dealers in batteries, magnetos, dynamos, armatures, motors, contacts, torches, &c. Permanent directors: J. V. Rushton, 134, Mount Road, Penn, Wolverhampton, and G. F. Mortimer, The Croft, Finchfield Road, Wolverhampton. Solicitor: J. F. Partington, 42, Waterloo Road, Wolverhampton.

**E. J. Elliott (Wireless), Ltd.**—Private company. Registered January 22nd. Capital, £750. Objects: To acquire the business of a radio and electrical accessory dealer, carried on by D. Elliott at 6, Exeter Street, Plymouth. First directors: E. J. Elliott and D. Elliott, both of 2, St. Judes Cottage, Tothill Road, Plymouth. Secretary: R. W. Fennamore. Registered office: 6, Exeter Street, Plymouth.

**James Crawford (Electrical), Ltd.**—Private company. Registered in Belfast on January 18th. Capital, £5,000. Objects: To carry on the business of electrical and mechanical mills, &c. First directors: E. F. Crawford and J. Crawford, both of 20, Osborne Park, Bangor, Co. Down. Secretary: W. Keith. Registered office: 4a, Dublin Road, Belfast.

**Grant, Kent & Shield, Ltd.**—Private company. Registered January 25th. Capital, £1,000. Objects: To carry on the business of electrical, consulting, mechanical, radio and sound engineers, contractors, agents for and manufacturers and workers of and dealers in electricity, mechanical sound apparatus and equipment used in connection with the exhibition of cinematograph films, wireless and television instruments and apparatus, &c. Directors: W. H. Grant, 81, Buck Lane, Kingsbury, N.W.9, L. E. Kent, 42, Felstead Road, Orpington, Kent, and G. W. Shield, 57, Wolsey Crescent, Morden, Surrey. Registered office: 18, Grape Street, London, W.C.2.

**B.Q.T. Manufacturing Co., Ltd.**—Private company. Registered January 25th. Capital, £1,500. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in electrical fittings, lamps, reflectors, accumulators, fires, stoves and cookers, &c. S. A. Lancaster, Finsbury Chambers, 76, Finsbury Pavement, London, E.C.2, is the first director. Registered office: 65, Bishopsgate, E.C.2.

**Betterlight Power Pack, Ltd.**—Private company. Registered January 26th. Capital, £100. Objects: To carry on the business of electrical equipment specialists, electrical, mechanical, radio and general engineers, &c. Permanent directors: F. S. Johnston, 35, Alkrington Hall Road, South Middleton, Lancs, W. S. Johnston, 15, Towncroft Avenue, Middleton, and R. Nuttall, 22, King Street South, Rochdale. Secretary: F. S. Johnston. Registered office: Irk Bank House, Boarshaw Road, Middleton, Lancs.

## Companies' Returns

### Statements of Capital

**H. Featherstone, Ltd.**—Capital, £3,000 in £1 shares. Return dated June 7th (filed December 5th), 1939. All shares taken up. £3,000 paid. Mortgages and charges nil.

**John Dugdill & Co., Ltd.**—Capital, £10,000 in £1 shares. Return dated December 6th, 1939. All shares taken up. £3 paid, £9,997 considered as paid. Mortgages and charges nil.

**Bogota Telephone Co., Ltd.**—Capital, £300,000 in £1 shares. Return dated December 25th, 1939. 258,493 shares taken up. £245,993 paid, £12,500 considered as paid. Mortgages and charges nil.

**Lamp Manufacturing & Railway Supplies, Ltd.**—Capital, £9,000 in 5,500 preference and 3,500 ordinary shares of £1. Return dated December 22nd, 1939. 4,500 preference and 3,003 ordinary shares taken up. £4,503 paid on 4,500 preference and 3 ordinary shares, £3,000 considered as paid on 3,000 ordinary shares. Mortgages and charges nil.

**Donovan Electrical Co., Ltd.**—Capital, £50,000 in £1 shares. Return dated December 21st, 1939. 29,100 shares taken up. £29,100 considered as paid. Mortgages and charges nil.

**W. G. Cannon & Sons, Ltd.**—Capital, £3,000 in £1 shares. Return dated September 20th, 1939. All shares taken up. £9 paid, £2,991 considered as paid. Mortgages and charges nil.

**McGoff & Vickers, Ltd.**—Capital, £2,000 in £1 shares. Return dated November 30th, 1939. 1,750 shares taken up. £1,750 paid. Mortgages and charges nil.

### Mortgages and Charges

**Vulcansons, Ltd.**—Debenture charged on Bell Works, Harefield, Middlesex, and the company's undertaking and other property, present and future, including uncalled capital, dated January 8th, 1940, to secure all moneys owing to the holders or which may hereafter be advanced by them to the company. Holders: Barclays Bank, Ltd., Mrs. M. A. L. Heather, St. Margarets, Canadian Avenue, Catford, S.E., and Mrs. D. M. Potts, Hethersett, Sandal, Wakefield.

Satisfaction in full on January 8th, 1940, of debenture dated May 31st, 1938, and registered June 8th, 1938, securing advances made by Williams Deacons Bank, Ltd., to Herbert Heather.

**Mackenzie Williams, Ltd.**—Debenture charged on the company's property, present and future, including uncalled capital, dated January 1st, 1940, to secure £1,000. Holder: J. E. MacKenzie, 5, Stainton House, Exeter Park Road, Bournemouth.

### Receivers Appointed

**Rodd Engineering Co., Ltd.**—Leave of Court obtained for the appointment of E. G. Bourne, of 103, Streatham Hill, S.W.2, as receiver and manager, on January 13th, 1940, under powers contained in debentures dated July 16th, 1937, and April 20th, 1939.

**Charles R. Dibben, Ltd.**—H. N. Phillips, of 107, Fleet Street, E.C., was appointed receiver and manager on January 19th, 1940, under powers contained in debenture dated April 22nd, 1932.

### Company Liquidations

**W. M. Dance & Co., Ltd.**, wireless dealers, 57, Tyne Street, Blaydon-on-Tyne.—The statutory meeting of creditors was held recently at Newcastle, when the statement of affairs disclosed ranking liabilities of £881. In addition, a discount company were fully secured creditors for £131. The net assets were £163, leaving a deficiency, as regarded the creditors, of £719. The creditors decided that the voluntary liquidation of the company should be confirmed, with Mr. R. Ormond, 41, Grainger Street, Newcastle-on-Tyne, as liquidator.

**Charles H. Barratt & Co., Ltd.**, electrical engineers, Pendleton, Lancs.—The statutory meeting of creditors was held recently at Manchester, when a resolution was passed confirming the voluntary liquidation of the company with Mr. P. Nelson, C.A., Manchester, as liquidator. A committee of inspection was also appointed. The statement of affairs disclosed liabilities of £374 with net assets of £55, leaving a deficiency of £319 as regarded the creditors. After bringing in the issued capital of £252 there was a deficiency so far as the contributories were concerned of £571.

**Mylan & Smith (Engineers), Ltd.**—Particulars of claims by February 9th to the liquidator, Mr. R. W. Allott, White Hart Buildings, Rotherham.

**McHales Radio, Ltd.**—Particulars of claims by February 29th to the liquidator, Mr. F. E. Bendall, King Edward House, New Street, Birmingham.

### Bankruptcy Proceedings

**T. W. Dennison,** carrying on business under the style or firm of T. W. Dennison & Co., 40, Thornton Road, Bradford, electrical and radio engineer.—This debtor's public examination took place at the County Court, Manor Row, Bradford, recently. His statement of affairs showed gross liabilities of £2,162, of which £1,888 was expected to rank for dividend. There was a deficiency of £1,755. Debtor said that contributory causes of his failure were lack of capital, losses on contracts due to exceptional rise in prices since the crisis in September, 1938, and excessive withdrawals. The examination was closed.

**H. J. Bruchsaler,** trading as H. J. Brooklyn & Co., lately carrying on business at Daimler House, Paradise Street, Birmingham, electrical distributor.—When the public examination was mentioned at the Court House, Corporation Street, Birmingham, recently, the Official Receiver stated that debtor had been interned. In reply to the Registrar he said that he thought he would be able to obtain debtor's temporary release so that he could attend for examination. No statement of affairs had been returned. The Registrar adjourned the proceedings.

**J. C. Nield,** The Old Bull, 17, Guildhall Square, Carmarthen, radio dealer, &c., formerly carrying on business at 9, Hall Street, and St. Mary Street, Carmarthen.—The adjourned public examination was held at the Guildhall, Carmarthen, recently. According to the statement of affairs returned there were ranking liabilities of £2,211, and an estimated deficiency of £1,807. In reply to the Official Receiver, debtor said he had not written up his books completely, and he had no record of his personal expenses. The examination was closed.

**W. N. Bishop,** 39, College Avenue, Maidenhead, electrical engineer.—This debtor's public examination was held recently at the Town Hall, Windsor. The statement of affairs returned disclosed ranking liabilities of £727 and assets of £107, leaving a deficiency of £620. Debtor attributed his failure to lack of capital and loss of work due to present conditions. The examination was adjourned for closing.

**A. J. Davis,** 15, Bridge Street, Exeter, wireless dealer and electrician.—The public examination was held at the Castle, Exeter, recently, when it was reported that debtor's ranking liabilities amounted to £652. His deficiency was put down at £573. He said that formerly he did a good trade in battery charging, but his customers left the district for new building estates. In addition, the crisis of 1938 had caused a further decline in the takings. The examination was closed.

## Reports and Dividends

**International Combustion, Ltd.**—Presiding at the annual meeting on January 29th Mr. G. R. T. Taylor (chairman) said that shareholders would realise that, due to the dislocation caused by the war, there had inevitably been a contraction in their output since its advent. Also, difficulty was experienced in obtaining delivery of many of the new machines required to expedite manufacture of their equipment.

Mr. G. C. Usher (managing director), in seconding the resolution for the adoption of the report and accounts, said that their order book for the first three months of the current financial year, in respect of normal activities, compared favourably with the corresponding period for last year. They had many important boiler and allied plant orders going through the shops and sufficient to keep their works busily employed for some considerable period ahead. Well over 50 per cent. of the turnover of their grind-

(*Continued on page 145.*)

# STOCKS AND SHARES

TUESDAY EVENING.

WEATHER conditions have played their part this week in restricting Stock Exchange business in some measure. The strength of the gilt-edged and other investment markets is still an outstanding feature. Many million pounds of British Government stock have been sold during the past ten days by people who, having bought previously, elect to take the handsome profit now available. No difficulty has been met in finding a home for the stock, and after each mild reaction in prices, the market has recovered.

Industrial issues are in demand, more particularly those of the best class undertakings. At the risk of being tiresomely reiterative, it must be repeated that scarcity of stock is amongst the principal factors in the Stock Exchange markets to-day. Speculation, except in gilt-edged and Home Railway stocks, is passive.

## Gilt-Edged Conditions

Another week of high activity in the gilt-edged market has kept prices constantly on the move, although on balance the advance has not made much headway against heavy bouts of profit-taking. Since the latter has been tempted by uncommonly quick and substantial appreciation in gilt-edged securities, the net advance, while modest, is accounted a satisfactory enough performance which has in no way shaken the opinion of those who maintain that War Loan is bound for par. War stock has, in point of fact, changed hands above 99, and the century is thus little more than a point out of reach.

Further consideration of the Treasury's scheme for converting the £350 millions of 4½ per cent. Conversion stock into a short-dated 2 per cent. issue seems to have strengthened the conviction that nothing but a grave accident could stand in the way of long or medium term loans at around 3 per cent. when the main borrowing programme comes to be launched. Senior stocks of the London Transport Board have been marked up by about 4 points in conformity with the new level of yields on safety-first investments. Certain of the Central Electricity Board issues are a point up.

## Electricity Supply Shares Advance

After a spell of unwonted indifference to the course of gilt-edged prices, the market in electricity supply shares has given signs this week of feeling the benefit of the stimulus. Rises of a shilling or more in nearly a score of the leading shares witness the tendency for money to investigate a widening field of investment, as the return from gilt-edged securities dwindles. Among the shares particularly singled out at present for attention, Midland Counties at 35s. 9d., Scottish Power at 33s. 3d., Yorkshire Electric at 35s., Electrical Distribution of Yorkshire at 36s. 3d. have all made ground. County of Londons show an advance of 1s. 3d. to 37s.; Bournemouth and Poole have gained a like amount to 58s. 9d. British Power & Light are 1s. better at 27s., while Clyde Valleys, at 35s., and Lancashire Electrics, at 31s. 3d., are also up on the week. Notting Hill preference (lately depressed by the deferment of the dividend) have picked up 10s. to £10, the par value. Altogether, the market is running into something like its expected form, and a satisfactory batch of dividends in the coming weeks could be counted upon to accelerate the process. There has been little noticeable reaction to the questions addressed in Parliament to the Minister of Transport in connection with the Central London group's decision to raise electricity charges.

## Equipment and Manufacturing

Evidence of the gilt-edged market's influence on other sections of the Stock Exchange is detected, by some, among electrical equipment issues. Leading shares such as General Electrics and British Insulated are quoted higher in response to the inquiry for equities of sound character. Both shares are 1s. 3d. to the good, the former at 76s. 3d. and British Insulated at £4. The yield is around 5 per cent. in each case. Telegraph Constructions are firm at 35s., after a rise of half a crown, and Automatic Telephones have put on 1s. 3d. to 43s. 9d. Both issues of Henley's, ordinary and preference, have advanced to 20s. In the more general engineering section, Tube Investments, having risen 2s. to 92s., stand higher than at any time last year; the wartime dividend policy of this company envisages no increase in the present rate of distribution, and, so far as can be foreseen, little probability of a decrease. The shares pay 5¼ per cent. on the money. Both Babcock & Wilcox, at 44s. 6d., and British Aluminium, at 52s., are up on the week. Vickers have continued their recovery, to 18s. 9d. On the dull side Electric Constructions, at 32s. 6d., and Reyrolles, at 37s. 6d., show the main movements.

## Motoring Equipment

This week's slight set-back in the price of J. Lucas shares coincided roughly with the publication of the first figures of the year to show the effects of taxation and of the petrol-ration, on motor car registrations. Probably there is little connection between the two events, since the figures, although large, were much as had been expected. Lucas shares have, in point of fact, been a popular equity over the past few months, despite the inevitable slump in the motor car business; and the yield of £5 11s. 6d. per cent. on the current 15 per cent. dividend indicates confidence in the company's wartime prospects. The 1s. shares of S. Smith, also makers of motor accessories, are a firm market at 7s. 6d., yielding 6⅔ per cent. on the 50 per cent. dividend last paid.

## Cable and Wireless

Cable and Wireless 5½ per cent. preference stock dogs the footsteps of the 3½ per cent War Loan; the quotation for each has been over 99 this week. There is, of course, about 2 per cent. difference in the yields. Cable and Wireless ordinary stock goes from strength to strength, a further advance of a point raising the price to 61½. Both the ordinary and preference shares of Globe Telegraph have responded to the improvement in Cable and Wireless stocks, which fill a large section of the company's portfolio of investments. The ordinary, at 30s., have gained half-a-crown, and the preference half that amount at 26s. 3d. Anglo-American Telegraph point the growth of confidence in the revenue position since the dividend declarations; the preferred has moved up from 94½ to 96½ and the deferred from 21½ to 22½.

## Westinghouse Brake and Signal

A dull tendency in the price of Westinghouse Brake shares over recent weeks has been reflecting uneasiness as to what would be disclosed by the accounts for 1938-9. Their publication fulfilled misgivings to the extent of causing a drop in the quotation from 38s. 9d. to 35s., a price lower than has been seen for a number of years, and nearly £1 below the best of 1939. Profits are shown to have fallen by £173,600 to £89,000, the distribution for the year is 10 per cent. against 17½ per cent. previously. Contract losses have been allowed for in striking the balance. These losses are assumed to be connected with the Polish State Railway contract. Although this work had been 86 per cent. completed a twelvemonth ago, payment is understood to have been spread over a period. In advance of further details, the size of the setback in profits is being taken as an indication that most, if not all, of the presumed loss has been written off. The brighter aspect of the situation lies in the fact of the company being able to pay comfortably a 10 per cent. dividend despite the particularly hard stroke of misfortune. A cut in the dividend on Consolidated Signal shares becomes virtually inevitable, the chief source of the company's revenue being Westinghouse distributions: the quotation has dropped by 15s. to 45s.

## Transport and Traction

Home railway stocks have again been the subject of much activity, at rising prices, under the double stimulus of, on the one hand, the example of the gilt-edged market, and, on the other, the belief in an early settlement with the Government of wartime compensation terms. Hopes on this occasion have a better foundation than those which have been leading to constant disappointment for a month and more, the Minister of Transport having hinted, in Parliament, at an early statement. That estimates of the agreed terms are framed on optimistic lines is evident from the raising of the more speculative issues to prices which could not be justified by the last published earnings. Southern preferred at 71 has advanced 3 points on the week and 6 points since a fortnight ago; in the same periods the 5 per cent. preference has gained 3 and 4½ points respectively, the quotation going over par for the first time for more than a twelvemonth.

## Transport "C" Stock Bargains

Comment has been caused by the marking of bargains at, and a fraction above, the minimum price of 65 at which London Transport "C" stock has long been marooned. Few people, however, are expecting compensation terms on a scale to warrant the minimum quotation, which, being a bar to free dealing, remains a figure of mystification and, sometimes, of exasperation. All the same, someone is evidently backing an optimistic view of the prospect. Full accounts of British Automobile Traction indicated that only the higher taxation charges prevented a further rise in the distributable profits. T. Tilling shares are to be converted into stock.

## Debenture and Preference Stocks

In view of the continued dearth of investments available under this heading, attention may be drawn to the following group of electricity supply and electrical manufacturing stocks at present in the market:—

| Stock or Shares | Price | Current Yield £ s. d. |
|---|---|---|
| London Power 3½% Red. Deb. ... ... ... | 95⅞ | 3 13 0 |
| Adelaide Elec. Supply 4½% G. Red. Deb. ... | 103 | 4 7 3 |
| Madras Elec. Trams 5½% Red. Deb. ... ... | 100 | 5 10 0 |
| Midland Counties 4½% Preference ... ... | 21/– | 4 0 9 |
| Palestine Elec. Corpn. 4½% Preference... ... | 18/6 | 4 17 3 |
| British Thomson-Houston 7% Preference ... | 31/– | 4 10 3 |
| English Electric 6½% Preference ... ... | 29/– | 4 9 6 |

British Thomson-Houston is controlled by Associated Electrical Industries.

# ELECTRICAL COMPANIES' SHARES

## Prices, Dividends and Yields

| Company | 1939 Highest | 1939 Lowest | Dividend Previous | Dividend Last | Price Jan. 30 | Rise or Fall | Yield £ s. d. |
|---|---|---|---|---|---|---|---|
| **Home Electricity Companies** | | | | | | | |
| Bournemouth and Poole | 68/3 | 56/– | 15 | 15 | 58/9 | +1/6 | 5 2 0 |
| British Power and Light | 30/9 | 21/– | 7 | 7 | 27/– | +1/– | 5 3 8 |
| City of London | 33/9 | 22/– | 7½ | 7½ | 26/6 | — | 5 13 2 |
| Clyde Valley | 38/6 | 26/9 | 8 | 8 | 35/– | +6d. | 4 11 5 |
| County of London | 46/9 | 28/– | 10½ | 10½ | 37/– | +1/6 | 5 13 6 |
| Edmundson's: | | | | | | | |
| 7% Pref. | 31/6 | 27/6 | 7 | 7 | 29/– | +1/– | 4 16 7 |
| Ord. | 27/9 | 18/– | 9 | 6 | 25/– | +1/6 | 4 16 0 |
| Elec. Dis. Yorkshire | 41/6 | 32/– | 9 | 9 | 36/3 | +6d. | 4 19 5 |
| Elec. Fin. and Securities | 48/3 | 39/– | 12½ | 12½ | 40/– | — | 6 5 0 |
| Elec. Supply Corporation | 51/9 | 40/– | 12 | 12 | 41/3 | — | 5 16 0 |
| Isle of Thanet | 20/– | 15/– | 4 | 4 | 15/6 | +6d. | 5 3 3 |
| Lancs Light and Power | 34/6 | 25/– | 7½ | 7½ | 31/3 | +6d. | 4 16 0 |
| Llanelly Elec. | 22/6 | 16/6 | 5½ | 5½ | 20/– | — | 5 10 0 |
| Lond. Assoc. Electric | 30/– | 18/– | 7 | 7 | 20/– | — | 7 0 0 |
| London Electric | 34/3 | 20/– | 7 | 7 | 26/3 | — | 5 6 8 |
| London Power Deb. Red. | 106½ | 97 | 5 | 5 | 104½ | — | 4 15 6 |
| Metropolitan | 51/– | 32/6 | 12 | 12 | 37/– | — | 6 9 9 |
| Midland Counties | 39/6 | 30/– | 8 | 8 | 35/9 | +2/– | 4 9 6 |
| Mid. Elec. Power | 41/9 | 33/6 | 8 | 9 | 36/3 | — | 4 19 4 |
| Newcastle Elec. | 28/9 | 25/– | 7 | 7 | 26/3 | — | 5 6 8 |
| North Eastern Electric: | | | | | | | |
| Ordinary | 32/3 | 23/6 | 7 | 7 | 28/6 | +6d. | 4 18 3 |
| 7% Pref. | 32/6 | 26/– | 7 | 7 | 30/6 | — | 4 11 10 |
| Northampton | 48/– | 41/– | 10 | 10 | 42/6 | — | 4 15 0 |
| Notting Hill 6% Pref. (£10) | 13½ | 10½ | 6 | 6 | 10 | +½ | — |
| Northmet Power: | | | | | | | |
| Ordinary | 46/6 | 30/6 | 10 | 10 | 37/– | +9d. | 5 8 1 |
| 6% Pref. | 29/– | 23/6 | 6 | 6 | 27/– | — | 4 9 0 |
| Richmond Elec. | 29/– | 21/6 | 7 | 7 | 23/9 | — | 5 18 0 |
| Scottish Power | 38/9 | 27/6 | 8 | 8 | 33/3 | +9d. | 4 16 6 |
| Southern Areas | 22/9 | 17/– | 5 | 5 | 19/– | +1/– | 5 5 3 |
| South London | 30/9 | 22/– | 7 | 7 | 22/– | — | 6 7 3 |
| West Devon | 23/3 | 18/– | 5 | 5 | 18/9 | — | 5 6 8 |
| West Glos. | 21/3 | 15/– | 2 | 2½ | 17/6 | +1/6 | 2 17 2 |
| Yorkshire Elec. | 38/6 | 27/9 | 8 | 8 | 35/– | +1/6 | 4 11 5 |
| **Overseas Electricity Companies** | | | | | | | |
| Atlas Elec. | 4/3 | 1/6 | Nil | Nil | 2/9 | — | — |
| Calcutta Elec. | 39/– | 25/– | 10* | 10* | 31/6 | — | — |
| Cawnpore Elec. | 34/6 | 27/3 | 10 | 10 | 28/9 | — | — |
| East African Power | 26/3 | 20/– | 7 | 7 | 23/6 | — | 5 19 2 |
| Jerusalem Elec. | 24/6 | 21/– | 7 | 7 | 21/6 | — | 6 10 4 |
| Kalgoorlie (10/–) | 10/6 | 9/– | 7½ | 7 | 10/6 | — | 6 13 4 |
| Madras | 31/– | 21/3 | 8* | 8* | 22/– | — | — |
| Montreal Power | 35½ | 30 | 1½ | 1½ | 34 | — | — |
| Palestine Elec. "A" | 27/3 | 19/6 | 7½* | 5* | 22/6 | — | 4 9 0 |
| Perak Hydro-electric | 19/6 | 12/6 | 6 | 2½ | 20/– | +6d. | 2 10 0 |
| Shawinigan Power | 25 | 20 | 85cts. | 83cts. | 25½ | +½ | — |
| Tokyo Elec 6% | 63 | 33 | 6 | 6 | 65½ | — | 9 0 6 |
| Victoria Falls Power | 73/9 | 60/– | 12½ | 15 | 72/6 | +1/6 | 4 2 9 |
| Whitehall Investments Pref. | 19/6 | 10/– | 7½ | 7½ | 13/– | — | 11 10 10 |
| **Public Boards** | | | | | | | |
| Central Electricity: | | | | | | | |
| 1950–70 | 112 | 103 | 5 | 5 | 109 | — | 4 11 4 |
| 1955–75 | 115½ | 104½ | 5 | 5 | 110 | — | 4 11 0 |
| 1951–73 | 106½ | 101 | 4½ | 4½ | 105 | +1 | 4 5 7 |
| 1963–93 | 95½ | 84 | 3½ | 3½ | 93 | +1 | 3 16 1 |
| London Elec. Trans. Gtd. | 88½ | 83 | 2½ | 2½ | 91 | — | 2 15 0 |
| London & Home Counties | | | | | | | |
| 1955–75 | 107½ | 105 | 4½ | 4½ | 106½ | — | 4 4 6 |
| Lond. Passenger Transport | | | | | | | |
| A | 114½ | 103 | 4½ | 4½ | 111½ | +4 | 4 0 9 |
| B | 117½ | 102 | 5 | 5 | 112 | +4½ | 4 9 3 |
| C | 83½ | 64½ | 4 | 1½ | 65 | — | 2 6 2 |
| West Midland Joint Elec., 1948–68 | 112½ | 104½ | 5 | 5 | 106 | — | 4 14 4 |
| **Telegraph and Telephone** | | | | | | | |
| American Tel. & Tel. | 210 | 159 | 9 | 9 | 209½ | — | 4 6 8 |
| Anglo-Am. Tel.: | | | | | | | |
| Pref. | 101½ | 82 | 6 | 6 | 96½ | +2 | 6 4 4 |
| Def. | 23⅝ | 17 | 1½ | 1½ | 22½ | +1 | 6 13 4 |
| Anglo-Portuguese | 24/– | 16/6 | 8 | 8 | 20/– | — | 8 0 0 |
| Cable & Wireless: | | | | | | | |
| 5½% Pref. | 97 | 75 | 4½ | 5½ | 98½ | — | 5 11 8 |
| Ord. | 57½ | 35 | 4 | 4 | 61½ | +1 | 6 10 4 |
| Income | 100 | 85½ | — | — | 95½ | — | 4 3 7 |
| Canadian Marconi $1 | 6/– | 3/9 | — | Nil | 5/– | — | — |
| Globe Tel. & Tel.: | | | | | | | |
| Ord. | 32/3 | 22/6 | 7½* | 7½* | 30/– | +½ | 5 0 0 |
| Pref. | 26/9 | 20/– | 6 | 6 | 26/3 | +1/6 | 4 11 5 |
| Great Northern Tel. (£10) | 38 | 18 | 20 | 20 | 20½ | — | 9 15 2 |
| Inter. Tel. & Tel. | 10½ | 5 | Nil | Nil | 5½ | — | — |
| Marconi-Marine | 30/– | 23/– | 7½ | 10 | 27/6 | — | 7 5 6 |
| Oriental Telephone Ord. | 2½ | 42/6 | 12* | 12* | 2⅜ | — | 5 1 0 |
| Radio Corpn. | 8⅞ | 5⅜ | 8 | 6 | 7½ | — | — |
| Telephone Props. | 14/– | 12/9 | 5 | 6 | 13/9 | — | 8 14 6 |
| Telephone Rentals (5/–) | 10/– | 6/3 | 10 | 10 | 8/3 | — | 6 1 3 |
| Western Union | 40½ | 19½ | 2⅜ | — | 32½ | — | — |
| **Traction and Transport** | | | | | | | |
| Anglo-Arg. Trams: | | | | | | | |
| First Pref. (£5) | 7/6 | 3/6 | Nil | Nil | 4/– | — | — |
| 4% Inc. | 16 | 5 | Nil | Nil | 9 | — | — |
| British Electric Traction: | | | | | | | |
| Def. Ord. | 950 | 500 | 5 | 5 | 650 | — | — |
| Pref. Ord. | 164 | 115 | 8 | 8 | 155 | — | 5 3 4 |
| Bristol Trams | 52/6 | 35/– | 8 | 10 | 42/6 | — | 4 14 1 |
| Brazil Traction | 13 | 6½ | $1 | 50c. | 10 | +½ | — |
| Calcutta Trams | 25/6 | 20/9 | 8 | 8 | 23/– | — | 6 19 2 |
| Cape Elec. Trams | 18/– | 16/9 | 5 | 5 | 17/– | — | 5 17 8 |
| Lancs Transport | 37/9 | 27/6 | 10 | 10 | 29/– | — | 6 18 0 |
| Mexican Light: | | | | | | | |
| 1st Bonds | 35 | 20 | 5 | 5 | 35 | — | — |
| Rio 5% Bonds | 82 | 47 | 5 | 5 | 78 | — | 6 5 0 |
| Southern Rly.: | | | | | | | |
| 5% Prefd. | 75½ | 48 | 5 | 5 | 71 | +3 | 7 0 10 |
| 5% Pref. | 99½ | 79 | 5 | 5 | 101 | +3½ | 4 19 0 |
| T. Tilling | 2½ | 32/6 | 10 | 10 | 37/6 | — | 5 4 7 |
| Tilling & B.A. | 54/6 | 43/9 | 9* | 8* | 47/6xd. | +3/– | 3 7 6 |
| West Riding | 37/9 | 30/– | 10 | 10 | 28/9 | — | |
| **Equipment and Manufacturing** | | | | | | | |
| Aron Electricity Ord. | 32/3 | 22/6 | 15 | 15 | 22/6 | — | — |
| Assoc. Elec.: | | | | | | | |
| Ord. | 45/3 | 30/– | 10 | 10 | 38/3 | — | 5 4 9 |
| Pref. | 36/6 | 30/– | 8 | 8 | 32/6 | — | 4 18 6 |
| Automatic Telephone & El. | 48/9 | 37/– | 10 | 12½ | 43/9 | +1/6 | 5 14 2 |
| Babcock & Wilcox | 48/– | 37/– | 10 | 12½ | 44/6 | +1/6 | 5 12 1 |
| British Aluminium Ord. | 61/3 | 48/– | 12½ | 12½ | 52/– | +2/– | 4 16 2 |
| British Insulated Ord. | 88/– | 70/3 | 20 | 20 | 80/– | +1/6 | 4 12 6 |
| British Thermostat (5/–) | 16/– | 11/6 | 18½ | 18½ | 12/6 | — | 7 8 0 |
| British Vacuum Cleaner (5/–) | 22/6 | 8/– | 40 | 12½ | 10/– | — | 6 5 0 |
| Brush Ord. | 5/9 | 2/6 | Nil | Nil | 4/– | — | — |
| Callender's | 92/– | 50/– | 20 | 15 | 60/– | — | 5 0 0 |
| Chloride Elec. Storage | 82/– | 62/– | 20 | 15 | 3½ | — | 4 5 9 |
| Consolidated Signal | 96/– | 60/– | 36½ | 36½ | 2½ | −15/– | — |
| Crabtree (10/–) | 25/6 | 16/6 | 17½ | 17½ | 21/3 | — | 8 4 9 |
| Crompton Parkinson: | | | | | | | |
| Ord. (5/–) | 21/– | 12/6 | 15 | 29 | 17/6 | — | 5 14 3 |
| E. K. Cole (5/–) | 9/– | 2/6 | 10 | Nil | 4/– | −6d. | — |
| Elec. & Musical Industries (10/–) | 14/9 | 6/6 | 5 | Nil | 8/6 | −3d. | — |
| Electric Construction | 40/6 | 28/– | 12½ | 13½ | 32/6 | −1/6 | 8 6 2 |
| Enfield Cable Ord. | 58/– | 37/6 | 25 | 16½ | 47/6 | — | 6 16 10 |
| Electrical Switchgear (10/–) | 27/– | 23/– | 16 | 10 | 21/3 | — | 4 14 3 |
| English Electric | 36/6 | 25/– | 10 | 10 | 30/– | — | 6 13 4 |
| Ensign Lamps (5/–) | 16/9 | 13/9 | 25 | 25 | 15/– | — | 8 6 8 |
| Ericsson Tel. (5/–) | 43/– | 32/3 | 25* | 25* | 35/– | — | 3 11 5 |
| Ever Ready (5/–) | 26/6 | 16/9 | 35 | 30 | 26/6 | — | 5 13 2 |
| Falk Stadelmann | 27/– | 18/– | 10 | 6 | 17/6 | — | 6 17 4 |
| Ferranti Pref. | 25/6 | 21/– | 7 | 7 | 23/9 | +½ | 5 18 0 |
| G.E.C.: | | | | | | | |
| Pref. | 32/9 | 25/– | 6½ | 6½ | 28/9 | — | 4 10 6 |
| Ord. | 82/– | 61/– | 17½ | 20 | 76/3 | +1/6 | 5 5 0 |
| Greenwood & Batley | 29/– | 20/– | 7 | 15 | 22/6 | — | 13 6 8 |
| Hall Telephone (10/–) | 22/3 | 7/– | 15 | 15 | 18/9 | — | 8 0 0 |
| Henley's (5/–) | 21/– | 13/9 | 20 | 20 | 20/– | +1/6 | 5 0 0 |
| 4½% Pref. | 23/– | 18/– | 4½ | 4½ | 20/– | +1/6 | 4 10 0 |
| Hopkinsons | 46/9 | 37/– | 12½ | 15 | 43/9 | — | 6 17 0 |
| India-Rubber Pref. | 22/– | 17/9 | 5½ | 5½ | 20/– | — | 5 10 0 |
| Intl. Combustion | 121/3 | 97/– | 32½ | 32½ | 5⅝ | +½ | 5 15 6 |
| J. Lucas | 61/– | 42/6 | 15 | 15 | 53/9 | −1/6 | 5 11 6 |
| Johnson & Phillips | 42/6 | 32/– | 12½ | 12½ | 42/6 | — | 5 17 8 |
| Lancashire Dynamo | 72/– | 50/– | 25 | 25 | 57/6 | — | 8 14 0 |
| Laurence Scott (5/–) | 12/– | 8/6 | 15 | 15 | 9/6 | — | 7 18 4 |
| London Elec. Wire | 31/6 | 25/– | 12 | 7½ | 26/3 | — | 5 14 4 |
| Mather & Platt | 50/3 | 37/6 | 13½ | 13½ | 46/3 | +1/6 | 5 17 0 |
| Metropolitan Elec. Cable Pf. | 21/3 | 21/– | 5½ | 5½ | 21/3 | — | 5 3 0 |
| Murex | 85/9 | 63/9 | 20 | 20 | 78/9 | — | 5 1 6 |
| Pye Deferred (5/–) | 11/6 | 7/– | 25 | 25 | 7/6 | — | 16 13 4 |
| Revo (10/–) | 35/6 | 22/– | 17½ | 17½ | 21/3 | — | 8 4 9 |
| Reyrolle | 61/– | 52/– | 12½ | 12½ | 57/6 | −½ | 4 7 0 |
| Siemens Ord. | 26/9 | 17/– | 7½ | 7½ | 20/– | — | 7 10 0 |
| Strand Elec. (5/–) | 5/6 | 1/3 | 10 | 4 | 2/– | — | 8 0 0 |
| S. Smith (1/–) | 9/6 | 5/6 | 37½ | 50 | 7/6 | — | 6 13 4 |
| Switchgear & Cowans (5/–) | 15/– | 9/6 | 20 | 20 | 11/3 | — | 8 18 0 |
| Telegraph Condenser (10/–) | 7/6 | 5/– | 5 | — | 7/6 | — | — |
| Telegraph Construction | 2⅛ | 27/6 | 10 | 10 | 35/– | +½ | 5 14 3 |
| Telephone Mfg. (5/–) | 10/– | 7/– | 9 | 9 | 8/6 | +3d. | 5 9 1 |
| Tube Investments | 91/6 | 68/– | 23½ | 23½ | 92/– | +2/– | 5 5 6 |
| Vactric (5/–) | 4/3 | 2/– | 4 | Nil | 2/6 | — | — |
| Vickers (10/–) | 24/6 | 14/6 | 10 | 10 | 18/9 | +9d. | 5 6 8 |
| Ward & Goldstone (5/–) | 22/6 | 19/6 | 20 | 20 | 19/9 | — | 5 1 3 |
| Westinghouse Brake | 54/9 | 38/– | 17½ | 10 | 35/– | −⅝ | 5 14 3 |
| Walsall Conduits (4/–) | 31/9 | 21/3 | 55 | 55 | 25/– | — | 8 16 0 |
| West, Allen (5/–) | 7/6 | 5/– | 7½ | 10 | 5/9 | — | 8 14 |

* Dividends are paid free of Income Tax.

# CONTRACT INFORMATION

## Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

## Contracts Open

*Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), Great George Street, London, S.W.1.*

**Australia** — MELBOURNE. — April 2nd. State Electricity Commission of Victoria. Cable for three-phase 6.6-kV system. (T. 15010/40.)*

**Birkenhead.**—February 13th. Electricity Department. Electric lamps for one year. (January 26th.)

**Belfast.**—February 16th. Electricity Department. Mercury arc rectifier equipments, and fire-extinguishing apparatus. (See this issue.)

**Birmingham.**—February 9th. Electric Supply Department. Three electrically driven pumps. January 12th.)

**Cardiff**—February 5th. Electricity Department. E.h.v. sub-station switchgear and e.h.v. and l.v. paper insulated cables for one year. (January 12th.)

**Erith.**—February 26th. Electricity Department. Materials for twelve months. (See this issue.)

**Gellygaer.** — February 16th. U.D.C. Electrical apparatus and materials for one year. (January 19th.)

**Heston and Isleworth.**—February 12th. Electricity Department. Sheet-steel housing and e.h.v. truck type switch. (January 26th.)

**Hull.**—February 20th. Electricity Department. Stores for one year. (See this issue.)

**Iran.**—TEHRAN.—March 1st. Ministry of Industry and Mines. Machinery for a cane sugar factory. (T. 23403/39.)*

**Leeds.**—February 16th. Electricity Department. Stores for one year. (See this issue.)

**London.**—BATTERSEA.—February 14th. Electricity Department. Electrical materials for one year from April 1st. (January 5th.)

**Middlesbrough.** — Diocesan Trustees. Installation of electric lighting at the Eston, South Bank Senior R.C. School. Architect, T. Crawford, 82, Borough Road.

**New Zealand.** — WELLINGTON.—Public Works Department. March 5th. Cables. (T. 30431/39.)*

February 13th. 110-kV outdoor switchgear and steelwork. (T. 15641/40.)*

March 12th. 110-kV outdoor switchgear and steelwork. (T. 28145/39.) Six 66-kV air-break switches. (T. 15486/40.)*

March 19th. 11-kV switchgear. (T. 15487/40.)*

March 26th. Four single-phase transformer units. (T. 28143/39.)* Switchgear and steelwork. (T. 30384/39.)*

April 2nd. Switchgear and steelwork. (T. 30385/39.)*

**Salford.**—February 14th. Corporation. Stores. (January 26th.)

February 21st. Stores. (See this issue.)

**South Africa.**—SALISBURY (S. RHODESIA).—April 15th. Municipality. Cables. (T. 30438/39.)*

CAPE TOWN.—March 6th. Electricity Department. Two 500 kVA (or alternatively two 600 kVA) three-phase transformers and two 50 kVA transformers. (T. 15056/40.)*

JOHANNESBURG.—March 4th. Railways and Harbours Administration. Two 10-ton and one 5-ton overhead electric travelling cranes. (T. 15509/40.)*

March 11th. Three 20-ton overhead electric travelling cranes. (T. 15508/40.)*

**Stoke-on-Trent.**—February 14th. Electrical Engineer's Department. Mains and cables, high-voltage truck type substation switchgear, transformers and meters for one year. (January 19th.)

**Swansea.**—February 19th. Electricity Department. Electrical materials for one year. (See this issue.)

**Turton.**—February 24th. U.D.C. Electrical materials for twelve months. (See this issue.)

## Orders Placed

**Denbighshire.**—County Public Assistance Committee. Accepted. Electrically driven mincing and mixing machine at Croesnewydd Hospital, Wrexham.—Peerless Electrical Manufacturing Co.

**Morecambe.** — Electricity Committee. Accepted. Feeder cable to Middleton.—Aberdare Cables.

**Middlesex.**—C.C. Accepted. Starter, switchboard and wiring equipment for plant and methane gas production at Mogden sewage works (£531).—Lancashire Dynamo & Crypto.

**Shipley.**—Electricity Committee. Accepted. Fire extinguishing apparatus for Wharf Street sub-station (£113).—Walter Kidde Co.

**Stoke-on-Trent.**—Electricity Committee. Accepted. Five isolation switches in connection with supply to British Aluminium Co. (£385). — Metropolitan Vickers Electrical Co.

Emergency Committee. Accepted. Lighting fittings for fire service stations. —Acme Showcard & Sign Co.

**Tynemouth.**—Town Council. Accepted. Electric wiring of school air-raid shelters.—W. W. Ward & Son; Electric Equipment, Ltd.

## Contracts in Prospect

*Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.*

**Acomb** (YORKS).—Development of estate, Carr Lane; J. S. Barlow's Trustees.

**Atherton.**—Houses (30), Hagg Fold estate; U.D.C. surveyor.

**Barking.**—Buildings; Chemical Supply Co., Ltd., Abbey Road.

Buildings; A. Ibbetson & Co., Ltd., River Road.

**Bathavon.**—Houses (50), for R.D.C.; surveyor, Council Offices, Bath.

**Beeston** (NOTTS). — Premises, Lilac Grove and Rose Grove, for J. Shipstone & Son, Ltd., The Brewery, New Basford, Nottingham; W. B. Starr & Hall, architects, 12, Victoria Street, Nottingham.

**Billingham.** — Ambulance garage, for U.D.C.; surveyor, Council Offices.

**Blackpool.**—Hospital; H. H. Vickers & Son, contractors, Whitegate Saw Mills, Blackpool.

**Blaydon-on-Tyne.**—Shelters; T. Hall, Urban District Council Offices, Blaydon-on-Tyne.

**Blyth.**—A.R.P. control centre, Broadway Circle; T. Wilson, borough engineer.

**Brierley Hill.**—Library, Pensnett, for U.D.C.; surveyor, Council Offices.

Rebuilding Swan Inn, Moor Lane; Frederick Smith, Ltd., Aston Brewery, Birmingham.

**Bristol.** — Communal shelter, Moorfields, and two shelters, Church Lane, Temple; city engineer.

**Burton-on-Trent.** — Schools shelters (£20,000), for E.C.; borough surveyor.

**Caernarvon.**—Central school at Nevin; W. Lloyd Jones, county architect, County Offices, Shirehall Street, Caernarvon.

**Cheltenham.**—Technical College extensions (£15,000).

**Chesterfield.** — Houses (22), Stonebroom; J. B. Wikeley, engineer and surveyor, Rural District Council Offices, Saltergate, Chesterfield.

**Coventry.**—Factory, Rowley's Green; Stirling Metals, Ltd., Northey Road.

Offices, store, print room, Lythalls Lane, for Self Changing Gear Co., Ltd.

Factory extensions, Torrington Avenue, for C. Weston & Co., Ltd., Quinton Road.

Houses (26), Ryton Croft; H. C. Weller, 185, Ansty Road, Wyken, Walgrave-on-Sowe.

Secondary school for girls, Dane Road, for the Education Committee.

(Continued on next page.)

## Financial Section (*Concluded from page 142*)

**Reports and Dividends (Continued)**

ing, screening, and filtering division was for export. Automatic electrical and mechanical controls able to stand up to the most arduous duties were a feature of these machines. Their Australian and South African companies had had a successful year's trading, while the Indian subsidiary was laying a sound foundation for the future. At home their other subsidiary, the Riley Stoker Co., had also had a good year. They had taken a small interest in Aberdare Cables, Ltd., and W. K. Porteous, Ltd.

**The Rheostatic Co., Ltd.,** held its annual meeting on January 30th, when Mr. L. Satchwell (chairman) who presided, said they had completely recovered from the fire at their works, which had occurred just before their last meeting. The turnover for the year under review had shown a very large increase on the previous year, notwithstanding the disorganisation caused by the fire, and the obvious trend justified further increases to buildings, plant and other fixed assets. The war had not so far affected the company's turnover of normal products. During the year their export of temperature control devices showed considerable increase, and that had been maintained since the outbreak of war. Due to the change in demand, they now had certain machinery free for other work, and they were in process of seeking orders for suitable manufactures direct from the Government.

**R. B. Pullin & Co., Ltd.,** held their annual meeting on January 25th, when Mr. R. B. Pullin (chairman), who presided, said that the extensions to their factory were completed and were now in full production. The factory for their subsidiary, the Pullin Optical Co., Ltd., was completed last year and production had now well commenced. They hoped it would be fully occupied in the next few months. With regard to 1940, they had in hand more work than at any time since the incorporation of the company.

**The Westinghouse Brake & Signal Co., Ltd.,** reports a decrease in net profits from £262,578 for 1937-38 to £88,932 for the year ended September 30th last. The directors point out that the 1938-39 figure is arrived at after making reserves against contract losses. The dividend for the year, however, is being maintained at 10 per cent., although last year's bonus of 7½ per cent. is not repeated. The reserve receives £25,000 and staff pensions, £5,000. The balance carried forward is £90,432 (against £105,106 brought in).

**The Singapore Traction Co., Ltd.,** reports a profit for the year to September 30th, after deducting debenture interest and London expenses, of £69,252, as compared with £55,580 for 1937-38. From this the following charges are met:—Debenture sinking fund, £2,915; depreciation and renewals, £20,000; income tax, £15,000; and written off compensation to Shanghai Electric Construction Co., £6,000. The final dividend is 5 per cent., making 7½ per cent. for the year (against 5 per cent.), and £9,308 is carried forward (against £3,198 brought in).

**E. K. Cole, Ltd.,** announce the payment of the half-year's dividend on the first preference shares. The six months' dividend due on February 1st on the participating preferred ordinary shares will be postponed until the accounts for the year ending March 31st are available.

Extensions to factory, Torrington Avenue, for A. C. Wickman, Ltd., Queen Victoria Road.

**Durham.**—Two cleansing stations at Jarrow; W. J. Merritt, county surveyor, Shire Hall, Durham City.

Additional accommodation for nurses at Chester-le-Street Institution; county architect, 43, Old Elvet, Durham.

**Ealing.**—Extensions to Ealing Park Foundry, Darwin Road; Dodge & Reid, architects, 72, High Street, Brentford.

Alterations to factory, Hanger Lane; C. W. Fox, architect, 8, Southampton Place, W.C.1.

Factory additions, Aintree Road; Gompertz & Meinrath, Ltd.

**Ellesmere.** — Houses, Welshampton, Hordley, and Tetchill sites, for R.D.C.; surveyor, Council Offices.

**Enfield.**—Factory extensions, Lockfield Avenue; P. Bilton, Ltd., 113, Park Street, W.1.

Factory extension, Bennett & Starling, Ltd., Windmill Hill.

R.C. school, Southbury Avenue; Sandy & Norris, 20, Bedford Row, W.C.1.

Houses, East Barnet Road; John Laing & Son, Ltd., Bunn's Lane, N.W.7.

**Eire.**—CURRAGH.—Power house extensions, Curragh Camp, for Commissioners of Public Works, Dublin; G. P. Fagan, secretary.

**Essex.**—Police houses, Canvey Island and Pitsea, for Standing Joint Committee; county architect, Chelmsford.

**Feltham.**—Shelters in various parts, for U.D.C.; H. G. Good, clerk, Council Offices, Feltham, Middlesex.

**Finchley.**—Factory extension, Friern Park; Specialloids, Ltd.

Factory extension, Ballards Lane; Newton & Wright, Ltd.

**Gateshead-on-Tyne.**—Theatre to seat about 300 people; W. Blackett & Son, contractors, Sutherland Street, Gateshead.

**Great Billing** (NORTHANTS).—Extensions, Flax Mills; Willett & Bartram.

**Hebburn-on-Tyne.**—Air-raid shelters at schools (£4,415); Page, Son & Bradbury, architects, 75, King Street, South Shields.

**Hemsworth.**—Fire station; S. Price, surveyor, Rural District Council Offices, Hemsworth.

**Hinckley.**—Board of Management of Hinckley and District Hospital and Nursing Institute (secretary, S. B. Smith), proposes erection of new male ward (£8,000); Pick, Everard, Keay & Gimson, architects, 6, Millstone Lane, Leicester.

**Hindley.** — Sewage works (£23,318); U.D.C. surveyor.

**Hednesford.**—Offices, Station Road, for Britannic Assurance Co., Ltd.; P. Skelcher, architect, 156, Edmund Street, Birmingham.

**Hull.**—Rescue, decontamination and repair depôt, Wellington Lane, off Beverley Road; city engineer, Guildhall, Hull.

**Hurstmonceaux** (HAILSHAM). — Telephone exchange, for H.M. Commissioners of Works; Contracts Section, H.M. Office of Works, Marine Hydro, Rhyl.

**Jarrow** (Co. DURHAM).—Electric lighting for the Infectious Diseases Hospital; J. S. Weir, borough engineer, Town Hall, Jarrow.

Houses (16); J. S. Weir, borough engineer.

Fire station and store in Percy Street; Maddison Brothers, builders, Burn Street, Jarrow.

First-aid post at Howard Street School and auxiliary fire station on new site for the T.C.; J. S. Weir, borough engineer.

**Lancashire.** — Dining hall, Council school at Huyton (£3,000); County Education Committee, Preston.

**Leigh.**—Auxiliary fire stations, Butts Bridge, &c.; borough engineer.

**Liverpool.** — Large store, Marybone-Cavendish Street; Calthrop Bros., Ltd.

**Longton** (STAFFS).—Additions to Cottage Hospital, Belgrave Road; governors.

**Merioneth.** — Police house, Glyndyfrdwy, for Standing Joint Committee; Norman L. Jones, county architect, County Offices, Dolgelley.

**Middlesbrough.**—Additions, Back Rockcliffe Road, for Middlesbrough Laundry, Ltd.; Kitching & Co., architects, 21, Albert Road, Middlesbrough.

Store, York Road, for L. Connolly; H. C. Garbutt, architect, 18, Albert Road, Middlesbrough.

Air-raid shelter, Zetland Road, for Dorman Long & Co., Ltd.

**Mirfield.**—Public shelters (50 persons each), near Three Nuns, Fountain Inn, and Shepley Bridge; U.D.C. surveyor, Council Offices.

**Morecambe.**—Extensions, Woolworth's, Euston Road; E. H. & R. R. Edgar.

**Newcastle-on-Tyne.**—Rebuilding timber and joinery works; J. W. Taylor, architect, Union Buildings, St. John Street, Newcastle.

Tobacco factory for J. Sinclair & Co.; Jackson & Sons, contractors, Corporation Street, Newcastle.

**Newton Abbot.**—Enlargement and improvement of abattoir (£5,400), for U.D.C.; surveyor, Council Offices.

**Northampton.**—Warehouse extensions, Wycliffe Road; H. Wright, Ltd.

Houses, Lyncroft Way; H. Wilson & Son, Ltd.

**Northamptonshire.** — Infants' school, Corby, for E.C.; G. H. Lewin, county architect, County Hall, Northampton.

**Northern Ireland.** — ANTRIM. — Filter house, County Mental Hospital Waterworks, for Committee; F. D. Brown & Sons, engineering consultants, Bank of Ireland Chambers, Queen's Bridge, Belfast.

BELFAST.—Nursery school building, for Edenderry Nursery School Committee; education architect, Victoria Street, Belfast.

**Northwich.**—Works in Water Street, for John Kerr & Co., Ltd., London Road, Northwich.

**Nottinghamshire.**—Laundry plant, Kilton Hill Hospital, Worksop, for C.C.; county architect, Shire Hall, Nottingham.

**Oldham.**—Hotel at Greengate, Chadderton, near Oldham, for C. R. E. Radclyffe, Hyde-Wareham, Dorset; F. H. Brazier, architect, 7, Market Street, Altrincham, Ches.

Alterations at Holmfield House, for the governors of the Royal Infirmary, Union Street West; T. Partington & Son, Bentley Street, Chadderton, Oldham.

**Paignton.** — Bungalows, Branksome Close; J. A. Proctor.

**Potters Bar.**—Fire and ambulance station, north side of Mutton Lane, for U.D.C.; T. T. Thorpe, clerk, Council Offices, Darkes Lane, Potters Bar.

**Preston.** — Works extension, Marsh Lane, for Atkinson Lorries, Ltd.; P. A. Baines & Son (Preston), Ltd., contractors, Paley Road, Preston.

**Rowley Regis.**—Licensed premises, Surfeit Hill; Wolverhampton & Dudley Brewery, Ltd., Park Brewery.

**Salford.**—Reconstruction of St. Charles Hall, Whit Lane, Pendleton; H. Greenhalgh, architect, 15, Mawdsley Street, Bolton.

**Scremerston** (near Berwick-on-Tweed).—New colliery for Scremerston Main Collieries; C. A. Nelson, managing director.

**Seaham Harbour** (Co. DURHAM).—Public and school shelters; J. B. Abbey, Urban District Council Offices, Seaham Harbour.

**Sheffield.**—Warehouse and preserving works, Carrfield Road, for E. Geldart, Ltd., Carrfield Road.

**Shrewsbury.**—Reconstruction of premises for Border Breweries (Wrexham), Ltd., Mount Street, Wrexham; V. W. Reece, surveyor to the Border Breweries, Ltd., Mount Street.

**Southall.**—Machine shop, The Green; Le Grand, Sutcliff & Gell, Ltd.

Shop, Lyndhurst Avenue; Amsden & Pope.

**Southampton.**—Extensions, Tatchbury Mount Colony; borough engineer.

**Southend-on-Sea.**—Development of site, 77-81, London Road; London Co-operative Society, Ltd.

**Standish.** — Destructor works, for U.D.C.; surveyor, Council Offices.

**Stoke-on-Trent.** — Cleansing depôt, Booth Street (£2,160); F. C. Gibson, Ltd.

Additions to Floral China Works, Mount Pleasant; A. Allerton.

**Sunderland.**—Air-raid shelter at Kennedy's Cobden Exchange; Hudson & Lucas, builders, Fontaine Road, Sunderland.

Church on the Plains Farm estate; the Rev. J. J. Smith, St. Nicholas Church, Sunderland.

**Sutton Coldfield.**—Shelters (200), in five contracts; borough surveyor, Council House, Sutton Coldfield.

**Swinton and Pendlebury.**—Grosvenor Road school (£14,800); H. Bennett, architect, Dales Brow, Swinton.

**Tamworth.** — Fire station scheme (£10,000), for Joint Fire Brigade Committee; B. K. Nightingale, architect.

**Thornaby-on-Tees.**—Air-raid shelter at the Town Hall; P. Brown, borough engineer.

**Wallasey.**—Police station, Moreton; borough engineer, Moreton.

**Walsall.**—Large hotel, site of Grand Theatre, for the Holt Brewery Co., Ltd.; Jeffries & Shipley, architects, Walsall.

**West Riding.**—Institution, Goole and Selby areas, and children's homes, Sherburn-in-Elmet, for P.A.C.; county architect, Wakefield.

**Widnes.** — Senior school; J. Holt, borough engineer and surveyor, Town Hall, Widnes.

**Wrexham.** — Demolition of existing buildings at rear of County Buildings and erection of garages, cleansing depôt and A.R.P. store, for Denbighshire Standing Joint Committee; Gittins & Sons, contractors, Aberderfyn, near Wrexham.

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# FORTHCOMING EVENTS

**Institution of Electrical Engineers.**—Thursday, February 8th. Institution, London, 6 p.m. "Telegraphic Typesetting," by Mr. H. H. Harrison.

*Meter & Instrument Section.*—Friday, February 2nd. Institution, London. 6 p.m. "The Maintenance of Relays and Associated Equipment," by Mr. J. R. Brookman (to be presented by Mr. F. J. Lane).

*Wireless Section.*—Wednesday, February 7th. Institution, London. 6 p.m. "Analysis of the Effect of Scattering in Radio Transmission," by Mr. T. L. Eckersley.

*Mersey & North Wales (Liverpool) Centre.*—Monday, February 5th. Liverpool Royal Institution. 6.15 p.m. Discussion on "Fire-fighting Equipment for Electrical Installations" (based on E.R.A. report), introduced by Messrs. J. Hacking and R. A. McMahon.

*Tees-Side Sub-Centre.* — Wednesday, February 7th. Cleveland Scientific and Technical Institute, Middlesbrough. 6.45 p.m. "Operating Experience with High-Voltage Alternators," by Mr. W. D. Horsley.

**Institution of Mechanical Engineers** (*North-Western Branch*). — Saturday, February 3rd. Central Library, Manchester. 2.30 p.m. "A Review of Forty Years' Development in Mechanical Engineering Plant for Power Stations," by Sir Leonard Pearce.

**Electrical Power Engineers' Association.**—Tuesday, February 6th. Caxton Hall, S.W.1. 6 p.m. "Internal Combustion Engines," by Mr. R. J. Welsh.

**Institution of Electronics.**—Thursday, February 8th. Royal Society of Arts, Adelphi, W.C.2. 6 p.m. "Phosphorescent Phosphors," by Dr. L. Levy and Mr. D. W. West.

**Diesel Engine Users' Association.**—Thursday, February 8th. Caxton Hall, S.W.1. 2.30 p.m. "Oil Engine Driven Pumping Plant at the Dunswell Pumping Station of the Hull Corporation," by Mr. C. Green.

**Electrical Trades' Commercial Travellers' Association.**—Friday, February 9th. Connaught Rooms, Great Queen Street, W.C.2. 12.30 for 1 p.m. Luncheon.

**Royal Institution.**—Friday, February 9th. Albemarle Street, W.1. "Ultra-Violet and Electron Microscopy," by Dr. L. C. Martin.